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THE

AMERICAN FIREMEN.

ESSAYS, LURID LEAVES,
SKETCHES, SPARKS,

A STANDARD WORK

ON

FIRE MATTERS.

BOSTON:
H. L. CHAMPLIN.
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INTRODUCTION.

THIS volume has been prepared expressly for the Firemen of America and their friends, to whom it is respectfully dedicated.

The author and compiler has endeavored to comprehend and gratify the wishes of firemen for a condensed treatise on matters pertaining to their special calling; and hence a general synopsis on the subject is herewith presented.

It is believed that no book heretofore published so fully and thoroughly covers the entire fire-field as does this publication; it presenting, in brief, nearly all that is of interest or value to those for whom it is designed.

As collateral to the main subject, Architecture, Building, and Insurance have received consideration in the general elaboration, and the article "What Constitutes Fire Proof Construction?" is commended to the attention of those who plan and build. Many of the "Sketches" and "Sparks" will be found interesting to all classes of readers.

It is not assumed that the book, as a literary production, is aught else than original and compiled patchwork, with its weft and woof of fire; but as a Manual for Firemen it may supply a want long felt. The few selections are from reliable sources, and the entire work is issued with the belief that it is substantially correct in its figures, details, deductions and generalizations.

That whatever merit the book may possess will be appreciated by its readers, is confidently expected.

C.

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THE ORIGIN OF FIRES.

FIRE, as a servant and friend, is useful and agreeable; as a master and an enemy, fire is a tyrant and a destroyer which requires, in this country alone, a standing army of more than 300,000 men to watch and fight. Great conflagrations are almost constantly occurring in some parts of our vast domain, and a record of the fires which daily happen in the world would fill a volume. Some days whole villages are destroyed,—insurance stocks go down and insurance companies "go up," and no inconsiderable percentage of the productive industry of the country is swallowed up

in repairing the damages done by fire. The Fire Marshal of Philadelphia, in his recent report, characterizes 1869 as the most extraordinary year ever known in the history of fires in that city. While the majority of the fires were soon checked, and caused comparatively trifling damage, yet there were a few of them which were most terribly destructive conflagrations. Concerning three of the greatest fires, the origin will probably never be certainly known. The great destruction of the Paterson warehouse far exceeded that of any previous fire in the city. The "Caldwell" fire destroyed a range of magnificent buildings, which had been built in the most substantial manner, and were supposed to be fire-proof. And the capacious snd splendid new hall of the Commercial Exchange Association was suddenly wrapped in flames. These three fires entirely baffled the patience and ingenuity

of the authorities who made search for the cause. In each case it was ascertained, beyond a doubt, that there was no possibility of incendiary origin. Everybody had some hypothesis or other to offer, especially in the case of the Caldwell conflagration, and newspapers were, for weeks, full of all manner of suggestions, as to how the disaster occurred. Considering the immense destruction of property by fire, every year, the satisfactory explanation of the origin of every one becomes a matter of general and particular importance. If a fire is the result of design, it is a matter of interest to know the offender, that he may be dealt with as his sins may deserve, and put under lock and key, out of temptation to repeat his villainy. If it has been caused by carelessness, or by ignorance of the laws of spontaneous combustion, we need to know it, so as to be on our guard against a repetition

of similar calamity. The fire losses of 1869, in the whole country, amounted to about $40,000,000. Of this, about $3,500,000 were in the city of New York, and somewhat over $5,000,000 in Philadelphia, the immense destruction of whiskey and other bonded stores at the Paterson warehouse accounting for the great difference between the two cities.

The Marshal, who has given as much attention to this matter as any man in the United States, gives several suggestions in reference to fires which proceed from carelessness, as well as those which have their origin in incendiarism.

He thinks Americans are the most careless people in the world. We overcrowd the floors of large buildings with merchandize of an inflammable nature. We construct our buildings carelessly, making them merely tinder boxes. Many even of our first-class

buildings are mere traps, with imperfections in their heating apparatus, which lead to sudden combustion. We leave stoves and lights at nights in such a way that it is only by the special interposition of Providence that the premises are not destroyed before morning. We empty our ashes into wooden boxes, and place them under the stairs. We leave dirty and greasy rubbish in basements and attics, to cause spontaneous combustion. We leave matches to be nibbled by rats and mice. We handle with the most improvident recklessness illuminating fluids which are as explosive as nitro-glycerine. As regards the origin of incendiary fires, he attributes their increase to : — 1st. The general demoralization of society, and growing lawlessness. 2d. The low standard of morality among certain business men. 3d. Reckless and excessive Insurance, and the ignoring of the moral hazard in underwriting policies.

It is a sorry comment on our lack of succees in investigating the causes of fires, and in bringing incendiaries to justice, that in 1869, only three persons were convicted of arson in New York, and only five in Philadelphia.

The Fire Marshal of San Francisco, in the report of his office from July 1st, 1869, to June 30th 1870, gives the total number of fires as two hundred and eighty-one. Of these twelve were caused by ashes; eighty-four by carelessness with candles, fire lamps and matches; thirty-three by defective chimneys; twelve by gas lights, and thirty-nine known to be incendiary.

The Philadelphia and San Francisco Marshals agree that in the black catalogue of human transgressions, there is no penal offence so arduous and so perplexing to deal with as that of arson. Next in enormity to murder, it is a crime engendered by the

most diabolical promptings of the heart. Base and cowardly in its conception, it is always concocted in secret, and its perpetration is ever covert and stealthy. Hence the detestable aud wicked act is generally enveloped in mystery and darkness, and the incendiary hides his tracks so completly as often to bid defiance to disclosure. While in the wake of all other crimes in the calender there are starting points to direct the detective, incendiarism seldom leaves a trace. All the evidences of guilt usually perish with the fire itself. The appointed agent who undertakes the task of detecting the infernal deed, is generally obliged to commence his investigations without a solitary clue, and is compelled to group in the dark at every step. Success occasionally crowns his exertions, but in many cases, after the exercise of all his sagacity and skill, as well as the most untiring persever-

ance, he fails to secure adequate proof of guilt. He frequently discovers enough to establish a clear moral case against the distrusted person, yet is unable to obtain evidence sufficient to warrant a verdict of guilty in a Court of Justice. The total number of convictions for arson in California to July 1st, 1870, was only forty-five, and the average term of imprisonment of the criminals, four years four months and eight days.

The New York Fire Department Committee on combustables, in their last report, say that "the casualties, in loss of life and property and injuries to person, arising from careless handling and the use of inferior kerosene oil, have been very great, averaging one fire or serious injury to person every day, and the loss of one life every week.

The sale of compounds of benzine, naphtha, and kerosene, under the name of liquid

gas — so named by parties claiming that by chemical and other processes, their explosive and dangerous qualities had been destroyed — has resulted in most disastrous consequences, from the deceptive illusion in the mind of persons induced to use it, believing it harmless, when, indeed, its use proved most dangerous.

A Chief Engineer of the Boston Fire Department, in discussing the causes of fires, says, "it appears from the statistics of fires in every large city in our Union, that thirty per cent have been traced to the following causes, viz: The deposit of ashes in wooden boxes or barrels, where they have been known to retain their heat sufficient for weeks to set fire. Defective flues, the result of faulty masonry, and other causes, are a fruitful source of fires. Look in whatever direction you may, you will see chimneys, partially or completely honey-combed from

the action of the coal gases, and their tops out of line so as to jeopardize, in windy weather, the lives and limbs of pedestrians passing along the streets. The unsafe manner in which hot air furnaces and steam-pipes are constructed must he apparent to all, from the large number of fires constantly taking place in every town and city in the State, and especially in churches, and large public buildings. It would seem almost incredible that such a manifest disregard for the safety of life and property could exist; but such is the fact. I know that many, and especially those that are engaged in putting in steam pipes for heating, assert that fire cannot be produced by steam pipes coming in contact with wood; but years of experience in this department have proved to the contrary; for wood, subjected to a constant heat, becomes in time chemically changed in its nature, dessication is constantly going on,

exhausting the oxygen contained in the wood in its natural state, leaving it composed of nearly pure carbon, when the slightest increase of heat over that to which it is ordinarily subjected will produce combustion. Then again, in case of fire in the building, from any other cause, with steam pipes improperly constructed, the wood, by contact, becomes as described above, and the fire appears in all parts of the building at one and the same time, thereby rendering the efforts of the firemen unavailable to its early extinguishment."

The frequency and alarming destructiveness of conflagrations should render them not only a theme for discussion, but for legislative and scientific investigation, so directed as to divise some means by which they may be prevented. An examination into many great conflagarations will disclose three prominent causes. The chief is, with-

out doubt, individual carelessness. No action, leglislative or other, will ever avert the danger arising from this. But while the cause cannot be wholly removed, attention should be turned to results, and endeavor so further to increase the efficiency of appliances for discovering, announcing and extinguishing fires, as to prevent their spreading with disastrous speed and fatality. The second cause is arson, and this, although fearfully on the increase, can be almost entirely prevented by united and determined action on the part of insurance companies, and stringent legislation. A third prominent cause of great fires is often lost sight of, or if recognized at all, is practically disregarded by insurers, blinded, as they too often are, to its importance by the hallucination that volume of premiums is synonymous with success. There is a want of discrimination against poorly constructed and

dangerous buildings. The custom of charging the same, or about the same rate upon buildings apparently of about the same construction, is absurd. The study of details in constuction, of those obscure but important differences between non-hazardous and extra-hazardous, receives far too little attention from insurance men. Because a building is made of brick, with walls, perhaps, of the standard thickness, and every *surface* indication of being equal to others of a standard class, it does not follow that it should be insured at the rate of a standard building. To those who have not had much practical experience as underwriters, or who have not made the profession of fire underwriting a study, it seems improbable and almost silly that one brick building in the same block, of the same height, with the same exposures and occupancy, should be worth twice as much to insure as another.

The merchant or manufacturer who occupies it will laugh at the bare suggestion of such a thing, and write down the agent who ventures to suggest it as an extortioner or an ass. Nevertheless, it is often the case. And if there is not one worth twice as much as another, it is difficult to find two buildings in any one block, though built of the same material and apparently in the same way, that will be rated the same by a skilful and experienced surveyor. Slight and hidden differences in the character of the material used or the quality of the work done, will convert what otherwise would have been, and to a cursory inspection seems to be a first class structure, into a mere man trap, sure to be entirely consumed if fire once breaks out in it, or sure to fall a shapeless ruin at the first touch of the destroying element.

A respectable appearing block of brick buildings was recently destroyed by fire,

because a tamed crow let fall on the flat roof, covered with prepared paper, a toy vase containing matches. The toy smashed, igniting the matches, and a fresh wind blew the tiny fire into a great flame. Had the roofing been slate, or even shingle, instead of a "patent" of paper, tar, and gravel, the freak of a mischievous bird would not have destroyed the structure.

Insurance companies and agents can, by proper discrimination, do much to remedy this. They can do justice to those who construct good buildings, and who deserve the benefit of low rates, in consideration of their comparative security from fire; and then the erection of superior structures will be greatly encouraged. On the other hand, they can and should charge such high, but only adequate rates upon the pretentious shells and dangerous man-traps.

No doubt that the origin of many great

fires has been either accident, carlessness or crime, and not because of defective buildings; but if the buildings had been constructed as they should have been the fires could have been confined, by ordinary effort, to the spot where they originated, or to a comparatively small space, and the great conflagarations would be the exception, and not the rule. Until underwriters shall place every risk upon its own merits — until there shall be a uniform and thorough system of survey, discriminating in favor of good buildings, and charging high rates for others, with merciless certaitny, — there will be little improvement in the security or permanance of our architecture. Property owners, builders and architects, can in no other way be so well instructed as through the medium of their pockets.

But no matter how thoroughly buildings may be constructed, so long as all the

materials are not absolutely incombustable, fires will occur, even if all "fire bugs" were exterminated. In many cases chemical oxidation, or spontaneous combustion, is the origin of fires which seem mysterious. There are new chemical agents now used in the every-day business of life, with which even professional chemists are but indifferently acquainted. Not only with the newly discovered substances and agents is this the case, but in articles which have long been familiar, are found latent powers of combustion, which are aroused into action by simple contact with other chemical agents equally harmless in themselves. Many fires have been caused by spontaneous combustion, which originate from the oxidation of linseed oil. Heat is always a product of oxidation.

Linseed oil, in a paint-pot, has little surface exposed in comparison with its entire

mass, and the heat generated by oxidation is diffused through the whole body of the oil, is radiated into the air and conducted away by the pot. When the paint is spread upon wood, the oil oxidizes rapidly, and heat is correspondingly produced; but being in contact with the conducting wood, is as rapidly carried away. If the wood were a non-conductor, and no heat was radiated, the oil would speedily take fire. When, therefore, this oil is mixed with sawdust, or spread upon cotton, wool, or paper, and the whole is kept away from a current of air, spontaneous combustion ensues. A painter rolls up his overalls, smeared and saturated with paint, some of which has been mixed with linseed oil, and some with benzine, throws them in a corner or lays them carefully away in some secluded place, and behold, the building is on fire.

THE FIRE ALARM TELEGRAPH.

ONE of the great, if not the greatest, achievements of modern science is the magnetic telegraph, and it marks an important era in human progress and civilization. Its application to the service of fire departments has revolutionized former methods of giving alarms and indicating the location of fires, and in every place where it has been introduced the testimony is universally in its favor. The idea of harnessing galvanic currents to fire-district circuits was first conceived and discussed by Dr. Wm. F. Channing, of Boston, who, in June, 1845, published a statement describing the application of the telegraph to fire alarm purposes, the principles then laid down by him being those which underlie the system which has been adopted and in general successful use.

The doctor's initial publication drew forth others on the same subject, until in 1848, the Mayor of Boston, recommended the adoption of the system of fire alarm telegraphy in his annual address to the city government. At this time a telegraphic engineer of Boston gave attention to the subject, and, in conjunction with Dr. Channing, completed the necessary apparatus to carry it into practical effect. The mechanism of the human system first suggested the form and combination of the signal and alarm circuits. The analogy with the functions of the motor and sensitive nerves of the animal organism is complete, the central office performing the functions of the brain, and the wires those of the nervous system. In 1851, the doctor submitted a detailed plan for a fire alarm telegraph to the city government of Boston, which was adopted, and on the 28th of April, 1852, the system

was put into practical operation. Since that time, though there have been made such changes and improvements as experience dictated in the working of the system, it has been in operation, giving the best results. It consists of the signal apparatus and wires by which the intelligence of fire is communicated to the central office, and the alarm apparatus operating on the same wires by which the number of the box the alarm comes from is struck on the various bells, to which are fitted the striking apparatus operated upon by the electric current directed by the operator in the central office.

At first two wires were used — one to convey the alarm from the box operated upon to the central office, and the other used by the central office to strike upon the alarm bells; but it was found that one wire would answer as well for all these purposes. The boxes and apparatus in them first used

to signal alarms were operated with a crank, upon a system which was found to be somewhat defective. Improvements were made in these boxes at different times, until the one now in use was adopted as the best. This is automatic in its operation. The box has double doors, upon opening the first of which a slide, with a handle to fit the forefinger, is observed in the inner door; by pulling down this slide, a lever on the inside, to which a weight is attached, is elevated, and acts on a sort of clock-work machinery by setting it in motion. The central part of the machine is a small wheel, upon which is a given number of cogs. In going around, these cogs act upon a small lever, which in turn produces vibrations in the circuit of electricity, which are registered on an alarm bell in the central office, the disturbance at the same time producing a single stroke on a small call-bell, which denotes the circuit

from whence the alarm proceeds; at the same time if the printing apparatus is put in motion, as it usually is (to see if the signal is true), the number of the station is printed out in dashes upon a slip of paper. Thus, if the signal box be 212, it is indicated by two strokes on the alarm bell, a pause; one stroke, another pause; and then two strokes. The number is printed off at the same time thus: - - - - - Immediately an alarm is given, the operator having assured himself of the identity of the box from which it proceeds, applies his hand to a set of levers, upon the switch-board, and switches on to an instrument called a three-dial repeater, the current of electricity. This repeater has three dials, with hands and figures like an ordinary clock. The minute hands are all placed at the figure 12. The other, or hour hands, are so placed as to give the different figures

representing the aggregate number to be struck; thus, if it be 325, the hour hand of the first dial is pointed to figure 3, that of the second to figure 2, and of the third to 5. The circuits are then all connected with the machine, which is set in motion, when it does its work to perfection. The machine can, however, be arranged so as to have one or two dials do the required work, regulating the number of the alarm. It can also be entirely dispensed with, and the work of sounding the alarm performed by the operator, so that in no event can a mishap occur in the work at the central office. All the boxes and their location are known by one number each, though these numbers are placed so as to indicate the locality. A circuit in the fire-alarm system is different from that in ordinary telegraphing. It is a metallic circuit, embracing an actual circle of electricity through metallic

wires, and when put in motion for alarm purposes, has a double action, or return motion, striking the alarm both ways. Each circuit embraces a certain number of signal boxes, gongs in engine houses, and alarm bells, and can be acted upon independently or in conjunction with any number, or all of the others from the central office. The current in all the circuits is tested often from the central office, so that the slightest interruption is noted. Each box contains, in addition to the alarm apparatus, a small telegraphic instrument, to enable the assistant at work on the wires to communicate instantly with the central office, and ascertain when the circuit is fully restored.

This in brief is the Fire Alarm Telegraph as it exists in many of the cities and larger villages of this and other countries, and the same general principle applies to them all. But in some details and minor

particulars, each locality has its modifications. The New York alarm telegraph, under the supervision of Charles L. Chapin, (who has made telegraphy a life study,) is probably as near perfect in its details as is possible for human ingenuity to devise. The "lines" are so built that only a few stations are embraced in each, and they are so interwoven that contiguous stations are upon different lines, so that an injury to one line, which might put one station out of order, would have no effect upon the next nearest station — because that one would be placed in connection with a distinct and separate line. The wires are very strong, and of unusually high conductivity, so that the currents of electricity my flow through without impediment. They leave the tall poles in front of the headquarters, and are conducted carefully over its roof and down to heavy spars, whence they pass directly

into the office. Here they are continued systematically to the batteries and instruments, but are so colored as to designate the particular office which each has to serve. The instruments and appliances at the central office consist of batteries, switch-board, register or receiver, indicator, transmitters, clock, repeater, and testing apparatus. The apparatus outside of the central office consists of automatic street signal boxes, and mechanical gong strikers. All of these are of the most perfect and elaborate construction, and most of them especially invented, designed and made for the service of the complete system. The "batteries" are compactly arranged in series of shelves, so as to be easily accessible. The shelves and stands are very thoroughly insulated, and the peculiar form of the battery keeps it perfectly clean and dry. The zinc element of this battery is so formed

as to make a cover to the glass jar, and thus prevent evaporation and the introduction of foreign matter in the interior. All batteries give off currents of electricity of various power, according to the amount of chemical substances destroyed — but they are almost universally constructed so that the plates are plunged into a reservoir of acids or chemicals, which act directly upon the plates, unless labor is expended upon them to keep them protected, or upon the other parts of the battery, to keep them clean. There is thus a large amount of destruction of material, independent of that due to the evolution of electric force. This destrnction is called local action. If this abnormal action can be guarded against, two beneficial results ensue — economy of material is secured, and constancy of electric force and incidental labor is saved. The constancy of force is a very great consideration in a

system where, for the first time, is introduced apparatus for the exact and instant measurement of electric force on every line. For more than twelve months a steady current was supplied by means of these batteries — the only labor required being the occasional supply of crystals. The principle of the long endurance is found in the arrangement by which a steady but minute supply of active chemical is supplied continually; the supply is regulated to the requirements of the line. Only one-tenth of expenditure of chemicals and labor are required. As it has been considered the best policy to keep the entire system of lines in a state of continuous and simple intercommunication, and as the expense of sustaining such batteries has been so much reduced, a very large number of cups are maintained. Besides these batteries others are provided for special purposes. The wires leading

from these batteries are carried into the operating room symmetrically, and with a view to their easy and instant identification.

In all cases where many wires carry electrical currents into offices, it becomes necessary at times to change the direction of these currents, — to transfer them from one wire to another for various purposes, — just as an engine and a train of cars are diverted from one track to another. The same name is given to these devices, viz., "switch." When many wires are introduced, each requiring its switches for its various purposes, the assemblage is called a "switch-board." That of the N. Y. F. A. is superbly mounted, is nine feet in length, and has upon it upwards of five hundred switches, each performing its own special duty, — but also arranged and grouped together so that very many may be moved by one common impulse, as when it is required to convert certain se-

ries on the entire number of lines from receiving to transmitting lines. To prevent oxidation the rubbing surfaces are heavily coated with platina. This combination gives the operator in charge the power of instantly applying to each and every line the changes required.

Usually it is desirable to send out the alarms, not only to all the alarm stations but also back again to the signal boxes. The change, therefore, of all the lines from "signal" (those that give the first alarm to the Central Office) to "alarm" (those that receive the alarm sent out from that office) can be effected by almost a single movement on the switch-board. In order to give simplicity and order to the arrangement of this instrument, each and every line has its series of switches for these various changes, arranged in rows. Every switch has designated upon it, in raised letters, the office it

performs. Each and every line is alike, and each is numbered. They are also divided in sections of eight lines, so that it becomes quite easy to refer to any line without loss of time. Immediately in connection with the switch-board is a series of "galvanometers," which measure the force of current on the line by deflection of a needle. A few degrees indicate a weak current, and many degrees a strong one. It is thus a valuable register of the state of the line — for the normal condition of the line being twenty degrees, ten degrees would indicate that the battery was becoming weak, and forty degrees would indicate that the battery was becoming stronger, which could not easily occur, or else that the resistance at the line was lessened, or that the current had found some short road easier for it to travel than through all the length of the line with its numerous magnets. This measurement by

degrees would be only a partial indication of the state of things. Hence, to every one of these galvanometers is added that which makes the test an exact one. The "resistance" of a circuit or line is that obstacle it presents to the free passage of the electric current. Through a short circuit of large wire a large volume of electricity will pass and exercise powerful force upon magnetic instruments. Through a long circuit of fine wire the reverse is the case.

The varying resistance of lines tested daily, and recorded in a book, is a complete history of the state of such lines. The instrument which contains the coils of measured resistance wires, by a combination of which any desired length of resistance is thrown in is called a "rheostat." In the central office it is arranged so that the changes may be made almost instantly, and at the same time can be read off in decimal

numbers, indicating miles and tenths of miles.

The "register" is an apparatus by which are recorded all the alarms that are sent into the central office, and all the tests of the day and night. The currents from the lines do not immediately proceed to this machine, but through the usual intervention of the relay magnet, of which fifty-six, in very compact form, are arranged upon the register table. These relays act upon the register, and also, at the same time, upon an electric annunciator, by which the number of the line is indicated. When a signal is communicated to the central office from a street box, the first operation the box performs is to disturb and break up the current that steadily flows through the lines at all times, and holds the relay magnet steadily charged. This break discharges the little magnet, its lever falls back, and, in so do-

ing, instantly performs four operations. First, it throws down into view the number of the line called into action; it causes a bell to be rung; it starts the register wheel-work into revolution, and it prints a dot in ink upon a broad band of paper, which is rolled slowly through the machine. If this single action was all that took place, a single dot would be printed on the paper, which would run out about three inches and then the revolution would instantly cease; but it can be arranged that the paper shall run only two inches, more or less, before it stops. As long, however, as the line continues to be active by sending off signals, just so long will the paper keep running — always stopping, however, two inches, more or less, as adjusted, after the last impulse from the line. Fifty-six pens, actuated by fifty-six magnets, are arranged beneath it, so that each and every one may be brought to bear upon

the paper. Each one is connected with a separate line. The pens are numbered to correspond with the lines, from one to fifty-six.

The street "boxes" form, of course, a very important part of the apparatus of the system. They are fastened to the poles or engine houses, and consist of an outer casing or house of iron, with the seal of the fire department on each, and a label covered with glass indicating to the public where the key, which opens the box, may be found. Every policeman is furnished with a key, and every fireman, and the insurance patrol. When a fire occurs in the neighborhood of a box, any one who first obtains the key opens the outer box. Within it he perceives a second iron box, and fastened to it a handle to be pulled down. Printed directions are also visible to guide in doing this simple thing in the right way, and also showing how it may be known that pulling the

handle has been effective. The moment the opener of the box hears a response he knows that his work is done. The officers in the department, who have keys for the inner box, to which the handle is fastened, discover, upon opening them, a third box, round and tightly closed up from the air; on the outside of this third box is to be seen simply a brass arm extending out to the right. This brass arm is fastened to the apparatus within the round box. The office of the pulling down handle on the second box is, to engage with and pull down this brass arm.

This action upon the arm winds up the machine within, which begins running down as soon as the brass arm is left free to move by the disengagement of the pulling down handle.

The other principal receiving instruments in the office consist of two extra and ordinary registers by which the communications

with the boxes which may be necessary for keeping the lines in perfect repair and good order are carried on, so as not to allow the main register to be cumbered by them. The apparatus for sending out the fire signals, received from and through the machines just described, consist of the repeater, the supplementary repeater, and the mechanical gong strikers.

The "repeater" is an instrument of great perfection of workmanship and design. It has a very important and extensive work to perform. When it is necessary to send out alarms it is, of course, of first importance to send to the various engine houses, and next to the street boxes. The last signals would be only for the information of the public. The circuit wheel, driven by regulated clockwork, is here again employed, but it is constructed far differently from that used in the street boxes. In this case each revolution of

the circuit wheel is made to throw a single signal. In other words, three revolutions will produce three taps of the bells. These signals are usually sent out with a very large battery power. It would be expensive to keep up so large a battery power upon every line as is usually thought best to employ for this tapping, so the circuit wheel is made very broad on the face, and teeth faced with thick platina are placed spirally upon it, and double springs, also heavily armed with platina, are placed so that the teeth come successively up to the springs and throw the battery power into them. Practically, the division is into eight sets of springs and eight sets of teeth on each wheel or roller. As the circuit wheel or roller revolves, it communicates successively the battery power into the springs 1 2 3 4 5 6 7 8, and as these springs unite with the lines, the power is successively thrown into the eight successive

lines. The full power of one large battery is thus brought to bear successively on the different lines in order, and a sufficient number of these circuit wheels, with their springs, are coupled together by gearing, so that all the lines through the city may be charged every revolution. How many of these lines shall be charged is entirely under control. The switch-board allows the operator to throw any number on or off of the repeater. The circuit wheels are driven by clock work and weight, and as long as the machine is made to run the wheels would go on to tap regular successive strokes on the bells through the city. But the requirements of the fire service are such that numerical signals from 1 to 998 may be sent out. Any such signal may be sent by the machine, — provided that a plan for cutting off the currents from the rollers or circuit wheels, at regular intervals, be provided. Thus, if it

is desired to send the signal 2 3 we allow the circuit wheels, in full battery connection, to revolve twice, all the bells on all the lines will tap twice, but as they revolve the third time the battery connection is severed from them, and they revolve inoperate. As they make their fourth revolution, the battery power is again turned on and three revolutions are made, giving three more taps. At the conclusion of the third tap, the battery power is again cut off, and it remains cut off until it is time to commence a second "round," then the same process is repeated. The cutting off and throwing on of the battery is accomplished by the use of regulating wheels,—each one cut to make the different desired signals. These wheels have teeth on them, and they can be attached to or detached from the repeater with ease and rapidity. Each tooth passes a certain point in the same space of time occupied by one revolution of the circuit

wheels. The agency of the teeth is to press certain springs together firmly. The springs being fixed, and the wheels revolving, if the first and second tooth of the wheel touch the springs and press them together, the battery power flies to the circuit wheel. If, however, the next tooth is missing the springs do not come in contact, and the battery is cut off. What signal shall be sent is, therefore, simply a question of how many teeth are left upon the regulating wheels, and in what order they occur. While regulating wheel 3 2 7 is attached to the repeater the instrument cannot send any other signal, — it is impossible to make any mistake. But a difficulty presents itself in carrying out this system of automatic telegraphy. The relation of revolution of the two wheels, that is the regulating and the circuit wheel, must be fixed; in order to send 998 the revolutions must be as 1 to 30, as 30 teeth would be

required to send all those 26 taps and the pauses between. It is quite evident then that the pause between the completed signal 23 and its repetition is much greater than between 998 and its repetition. It is desirable to have the pauses between rounds equal, and to be able to adjust it to a certain number of seconds. This is accomplished thus: Instantly after the last stroke of every signal a pin on the regulating wheel actuates a lever which immediately increases the speed of the train, which speed is kept up until the machine stops itself precisely at the point on the regulating wheel where it commenced its action. At the same instant that the speed is increased, another train of wheels is started in action which runs for a certain regulated interval of time and then stop itself, but before stopping itself it restores the parts of the other train to the condition they were before the speed was increased, so that when

again it starts it is upon the normal slow speed. The further office of this second train is, just as it is about to complete its action, to start again the first train, so that the complete signal is repeated. Now, as the second train is not tripped until the last working tooth of the regulating wheel acts, the regulating or second train goes into action much sooner on a short signal than on a long one; so that the first train cannot go into action again till the second train stops; so that the effect is, after a short signal the first train is tripped and started again almost immediately after it comes to rest; but after a long signal it has to wait until nearly the whole time occupied by the movement of the second train, and thus the pause is completely equalized. These actions of the two trains upon each other continue, and the signals are repeated with great accuracy and uniformity, as long as the trains continue running; but is ar-

ranged that after a certain interval the movement shall lock itself into rest, so that nothing can again call it into action except the will of the attendant who must make two movements analagous to the setting of the hair trigger and then pulling it. The locking arrangement is contrived so that it can be set to any number of rounds or repetitions of signals required by the department. If set to three, it will complete three rounds and then lock itself, or if set to one, but one alone will be sent. The object of the repeater is to send to any number of stations a correct numerical signal and repeat it at regularly-timed intervals. To receive alarms sent out are bells and large "gongs," which are struck with hammers moved by delicate clock-work machinery. The blows struck indicate the location of fire.

And now it seems as if nothing more is needed as an alarm agent, nor in the

method of its application to practical use; and each fire department which has the magnetic telegraph is more efficient than it would be with any other alarm system. It is proposed to supplement and enlarge the system so as to furnish *correct time* in public buildings and other places. With a magnetic clock, at the central station, put into galvanic connection with a number of other magnetic clocks, at various points, a whole city may be timed to a second, and so continue, without variation, for months or years. Already, in some cities, a start in that direction has been made, and designated hours are struck on the alarm bells, thus giving the inhabitants an opportunity to note the exact time and to set their timepieces accordingly. It is probthat the telegraph, modified and simplified, will always hold an important place among the agencies which serve and benefit mankind.

FIRE-EXTINGUISHING APPARATUS.

IT is fair to presume that observation and experience early taught the primitive races of mankind that fire and water are antagonistic elements in the domain of nature; and it would constitute an interesting speculation to elaborate the various probable methods used by the first firemen to convey and apply water to fire, whenever the latter escaped the limits assigned to it. At that time the chemical relation which the elements bear to each other was not understood, and the laws governing combustion, and the philosophy of hydraulics were to be learned. But it was doubtless apparent then that fire and water were not friends, and could not exist harmoniously together. It must have been apparent, even before the dawn of

science, that a small quantity of water when applied to much fire would pass off in the form of steam into the surrounding atmosphere; but when the quantity of water was comparatively large the combustion was arrested and the fire "put out." If the dwelling-tent or grain stack took fire the antedeluvian firemen would put on water, without knowing that it is composed of oxygen and hydrogen, or that fire is a process of union between oxygen and carbon. It is also probable that, at a very early date, a sort of *bucket system* existed, which may have served its day and generation pretty well. During the infancy of the race no lofty buildings were erected, and large quantities of water were not needed to extinguish the accidental fires incident to a pastrol people. What of the buckets? Their material, shape and capacity we can only conjecture. The first bucket

may have been a concentric piece of bark, an empty sea-shell, a disembowelled gourd, or a piece of rude pottery. But that there were cups of brass and of iron at an early date may be inferred from the fact that Joshua found such cups in the city of Jericho; and the prophet Jeremiah alludes to the manufacture of pottery as being no new thing in his time. In fact, frequent mention is made in Scripture of utensils which would hold liquids, and which may have served the purpose of fire extinguishers. But one of the earliest members of the bucket family was a bag-bottle, and for centuries it was the best retainer of unstable fluids in use. It is still in use among the nomadic tribes of Asia and Africa. These ancient bag-bottles were made from the skins of animals, which were properly dressed for the purpose. The openings in the skin were closed, except at the neck, through which

the liquor was to be received and discharged, and which was fastened with a string like a bag. They were of different sizes and shapes, as the skins of kids, goats or oxen might be used. Some made of ox-skins held sixty gallons each, and two were a load for a camel. In case of fire it was only necessary to untie the neck of the bottle, and then, by pressure, collapse the body of the bottle, which would eject the contents through hose, made from the intestine of an ox, with considerable force and effect.

After individuals coalesced into communities, and dwellers in tents became denizens of cities and villages, self-preservation against the ravages of fire made it necessary to devise something better than bottles to convey and apply water; and the genius of those times formed of wood a sort of tub, denominated a "piggin." It had one of its staves a a few inches above the others, which made it

a more convenient utensil to handle than was the flexible and yielding bottle. In the progress of time the oscillating handle was added and the bucket or pail attained to its present state of perfection. One of the first Bag and Bucket Companies in this country was organized in Boston, October 22, 1788, under the name of Phœnix Fire Society. One of its rules was that each member should keep constantly in good order, hanging up in some convenient place in his dwelling-house, under penalty of *three shillings* for deficiency, two leather buckets, two bags, and an iron bed key; the buckets to be painted, in every respect, conformably to the orders of the society; the bags to be one yard and a half in length, and three quarters of a yard in breadth, with strings to draw them up. The buckets and bags to be marked with the first letters of the owner's christian name, and with his surname at

length, under the penalty of *six shillings* for each bucket and each bag. Other rules, of course, required the members, in case of fire, to proceed to it forthwith, and use their best endeavors to put out the fire with the buckets, and save property in the bags.

And yet the bucket system, in suppressing fires, did not keep pace with the increasing wants of the service. The common lifting-pump was a happy conception. Next the force-pump. After this, a combination of two force-pumps arranged in a box, wherein they operated, conjointly, with considerable success. Again, to produce a steady out-flowing stream, an air chamber was added, and the present hand fire engine was the result. For more than two hundred years has this machine, in its various forms of development, been an almost marvellous power for good in every civilized country. Who will narrate its history and tell the

whole story of its conquests? The time for that, however, has not yet come, and, notwithstanding the recent advent of a wonderfully effective rival, the hand engine will doubtless for many years continue to be a machine with which to fight the destructive element and win new victories. It has too much real merit to be run off the track of popular favor very soon. And as it has attained to a high state of efficiency, and has won a long series of successes, and is a marvel of inventive and mechanical skill, it is safe to presume its merits will not quickly be ignored. Capital to the amount of nearly a million of dollars is now invested in the manufacture of this class of machinery, and the demand for such engines is increasing. In this country there are ten or twelve establishments where are turned out annually a hundred or more hand-fire engines, which are models of beauty, and in every respect

adapted to the service for which they are designed.

To ask who makes the best hand fire-engine would be as proper as to ask who carries the best watch, or who has the best wife. In either case the author does not assume to be arbitrator to settle the conflict of opinion.

The advantages which hand-engines possess are several and important. They are light, and are readily drawn to difficult points of access. Their cost is comparatively small, thus making them available to small communities. They are simple and durable in their construction, and require but little care and labor to keep them in effective condition. They are the pets of volunteers and serve to enlarge the area of sociability wherever they are kept. Again, they have *a history*, which is interesting to antiquarians. In the seventeenth century

they were rough, unpainted nondescript affairs, without the power of suction, but received their water from a line of leathern buckets. *Now*, they suck up a supply of water through twenty-eight feet of hose. *Then*, they squirted water only about fifty feet. Now, they eject the fluid two hundred feet. *Then*, they often gave out or broke down. *Now*, they hold out and wear well. The transformations and improvements which were made in fire-engines between 1670 and and 1870 were so numerous, successive and progressive, that in them we may read the intellectual development and inventive genius of mankind with clearness and certainty.

The hand fire-engine, and its *modus operandi*, is so well and generally known as hardly to need a description. It is a double force-pump, so arranged and operated as to cause a steady and copious stream or column of water to pass from the reservoir through

the suction-hose, the water-ways of the machine, and the leading-hose. This movement of the fluid is produced by the upward and downward motion of the piston-rods, which cause a vacum at the water-ways in the engine, and the atmosphere pressing on the surface of the reservoir water, with a force of fifteen pounds to the square inch, the water rushes in to supply the place made vacant by the expelled air. The suction power of an engine, therefore, is its capacity to produce a vacum, which, philosophers say, nature abhors. If the machinery were absolutely perfect, the drafting, or suction power of the engine would be sufficient to bring water from a depth of thirty-three feet; for a column of water of that length exactly balances a column of atmosphere of equal diameter to its entire weight. But owing to the difficulty of making machinery work air-tight, and to avoid pinching and friction,

engines are good ones which will "suck" at a distance of twenty-five feet.

The forcing of the water from the engine through the leading hose, is more of a mechanical matter, and requires real muscular effort, — "beef," the firemen sometimes call it, — and much depends upon the construction and condition of the engine as to what results are attained in projecting the water. With a given amount of muscular power applied to the piston-rod bars, that engine is considered the most effective which will eject the greatest quantity of water the highest and furtherest; and hence there has long been a rivalry among manufacturers to produce a superior engine; and among firemen there exists a disposition to consider the machine they run with as one that can't be beat. And as each manufacturer usually claims to have some "patent" attachments, which others do not possess, so do the fire-

men, who use his engines generally insist that no other maker can construct quite such good "suckers and washers" as are their favorites.

In 1518 there were, at Augsburg, fire engines called "instruments for fires," and "water engines, useful at fires," which, in appearance resembled monster saussage stuffers. A hundred years later there were machines which more resembled the fire engines of our times. An old writer refers to one he saw in 1617, and he describes one at Nuremburg, in 1656, which was placed on a sled ten feet long and four feet broad, drawn by two horses. It was a wooden water cistern, eight feet long, four feet high, and two feet wide, operated by twenty-eight men. It forced a stream of water an inch in diameter to the height of eighty feet. The cylinders lay horizontally in a box, but nothing is said of an air-chamber, and only a flexible pipe, without hose, was used.

In 1670 Van der Heides, two Dutchmen, invented and manufactured leathern hose and suction pipe; and in 1690 they published a book, in which were excellent engravings of nineteen conflagrations, seven of which the old engines had failed to extinguish, and twelve which the new engines had put out. The title of the book is "*Beschrijoing der nieumlijks uitgevonden Slang Brand-Spuiten.*" After reading the title American readers will not probably desire any further quotations from the book.

The English were slow to adopt the inventions of the Dutch, and at the close of the sixteenth century the only fire engines used in England were "hand squirts," or syringes, holding less than a gallon. When put into use, the piston was taken out, and the nozzle of the cylinder dipped into water and allowed to fill. Two men held and directed the syringe, and one man worked the plunger.

It was the modern toy squirt-gun intensified. These syringes were afterward fitted into a portable cistern, and furnished with levers for working the pistons.

At the close of the seventeenth century an Englishman named Newman patented an engine consisting of a strong oak cistern, upon wheels, with pumps, air-chamber, leather hose, and suction pipe, with a strainer. This form of engine was in use many years, without being materially improved; and the hand fire-engine of the present day is the direct descendant from the Newman engine, with, of course, various modifications and improvements. Another English invention was an engine constructed on the rotary principle, with twelve force-pumps arranged around a central air-chamber, into which they all discharged, and each could be operated independently, one man only being required for each pump. This was quite an

effective apparatus, considering that but one man was required to start it, and only twelve men were needed to operate it to its full capacity. At the commencement of the eighteenth century there were but two fire engines in Boston, and less than a score probably in America; and to procure a "water engine" from England or Germany, in good old Colony times, required more deliberation, reports, resolutions, orders, financiering and time than are now necessary to obtain a quarter of a million dollar cargo of merchandise from the Antipodes.

As already noted, modern American engines consist essentially of two vertical or slightly inclined double-acting force pumps, one under each end of a lever-beam, to which are attached long bars for numbers of men to grasp and move up and down, which cause the pumps to force water through the suction-hose into a metalic chamber filled

with imprisoned air, and thence through the leading hose and discharge pipe to a fire or point desired. The size of the pump cylinders vary from five inches to ten inches in diameter; the stroke of the piston-rods vary from eight inches to eighteen inches; the length of the power bars are from sixteen feet to twenty-five feet each. The materials of wood, iron, steel, brass and plating are frequently elaborately carved and polished, and tastly ornamented with mottoes, scroll-work, painted designs, etc., constituting all together such marvels of beauty as to elicit universal admiration.

Among the early makers of fire engines in this country were Agnew & Co., of Pennsylvania, and Thayer & Co., of Massachussetts, and several machines of those manufacturers are still in store at various parts of the country. Their use, however, have very generally been superceded by more modern,

elaborate and effective apparatus. The Thayer and Agnew "tubs" were nearly alike in principle, but in appearance and methods of operating they differed considerably. The Agnew engine was a "double-decker," quite high and showy, and required squads of men to be elevated over the heads of other squads while working the piston-bars. The Thayer engine was rather a "squatty" looking affair, and the operators were all on a level.

And now, O daring Fireman, what more hast thou with which to renew and continue the contest against the destroying element, as it breaks out anew with increased fury? What about that combination of Niagara and Vesuvius on wheels, which has filled the multitude with wonder? As a conquering giant comes the STEAM FIRE ENGINE, and its fiery pulsations are heard, and its saving deluge is witnessed in many cities of the

earth. No pen of poet or brush of painter can adequately describe and portray its achievements, or measure its power for good in this combustible world. No prophetic ken can discern the number and value of its successes in the future. That it may sometimes fail and get vanquished, as at the Chicago fire, is possible; but with due support, it will probably constitute *the reliance* of fire departments for a long time to come.

A full and complete history and description of the Steam Fire Engine would involve a history and description of the discovery and application of steam as a motive power, which is not the province of this work. But it may be interesting to note here that the steam engine proper was first invented and patented by Watt, in November, 1768; though the application of steam as a motive power, ante-dates this invention by many centuries — indeed, something was known

of its power and use before the Christian era, as quite successful experiments were made two hundred and thirty years before Christ, of which, however, we have but meager and imperfect accounts. No further material advance is known to have been made until the sixteenth and seventeenth century, when through the new art of printing, the works of Heron and Archimedes were disseminated and much read, and an age scarcely second to our own in the great number and variety of mechanical contrivances, was entered upon; vessels were propelled, water raised, and mines drained by steam as early as 1543, and various machines were made. But their application to great practical uses was of a comparatively recent date. The first successful attempt to apply steam as a motive power to fire engines was made by Brathwaite, at London, in 1830. He made a five-horse power machine which

weighed five thousand pounds. It was a success in so far as it demonstrated future possibilities, but it worked indifferently. In 1832 he made a steam fire-engine for the king of Prussia, and this was an improvement on the previous effort; but the royal patron did not order a duplicate.

On the 16th of December, 1835, occurred a fire in New York which raged during fifteen hours, destroying seventeen blocks of buildings, comprising six hundred warehouses and a loss of $17,000,000. This fire aroused insurance men and the business public to the necessity of devising and adopting some effective means to prevent the recurrence of similar conflagrations. Premiums were offered for steam fire-engines, and, in 1841, Mr. Hodges constructed an engine which was quite powerful and effective. But, besides lacking several essential requisites, it was too heavy for general use.

The first effective engine adapted to general service was made by A. B. Latta, early in 1853. This machine weighed about twelve tons and required four or six horses to haul it. The next year (1854) two more machines were constructed by the same maker, and a steam fire department was organized in Cincinnatti, Ohio, where Mr. Latta resided. In 1855 he made a steamer for the City of Boston, where it done good service, April 12, 1856, in saving from destruction a large market building.

At first, like nearly all new and useful inventions, the steam fire engine was met by opposition. The old firemen and others predicted disaster and failure. It was averred that such heavy and unweildly affairs would crush in the street sewers, sweep down lamp-posts, smash plate glass, pulverize paving, set sedge-stones askew, and set fires with sparks from the smoke-stacks,

and, finally, the boiler would burst and scatter death and destruction all around.

All objections and predictions however availed not to prevent the advent of "Niagara" and "Fire King." A new era had dawned, and old fogyism had to clear the track for the new comer, the existence of which soon became a fixed fact.

The engine of the Latta class is known as the "reciprocating" engine, having direct acting plungers. The boiler has a square box like a locomotive boiler, except that the furnace is open at the top where the chimney sets on. The furnace at the upper portion is occupied with a continuous coil of tubes opening into the steam chamber, the lower end passing through the fire-box and connecting with a force-pump outside, by means of which water is driven through the whole length of the coil. When the fire is started the fire-box is full of water, but the coils are

empty, and are kept so until they are hot enough, when water is injected, which immediately assumes the form of steam. Many minor improvements have been added to the "Latta" engine, but all the essentials are the same. The majority of steam fire-engines already constructed belong to the reciprocating class, and it would seem as if they are effective and good enough.

A first class reciprocating double-plunger engine, such as are now manufactured and in use, is a powerful machine, having the capacity to play four streams of water at the same time. This class is drawn by horses, and the weight is about seven thousand pounds. The boiler is thirty-six inches in diameter, and sixty-five inches in length; it contains three hundred copper tubes twenty-four inches long and one and one-fourth inches in diameter. The boiler is cased in wood, and covered with Russia iron, with

brass bands, and a brass dome and chimney casing. It has two double-acting plunger pumps, lined with brass, four and one quarter inches in diameter, and twelve-inch stroke, with rubber valves and brass valve seats. The steam cylinders are eight inches in diameter, and twelve-inch stroke, working on the the same piston rods with the pumps. The air-chambers are of copper, with a silver-plated globe signal lantern on top, with the name and number on the same. The wheels are of wood, the forward ones fifty-four inches, and the back ones sixty inches high. It has a brake applying to the back wheels and controlled by the driver. The driver's seat is fitted on the forward part of the engine, and has two side lamps. Two lengths of suction hose, made upon copper rings, each piece ten feet long and four and one half inches in diameter, are with the engine. The suction-pipe of the pumps is fitted on

each side with a brass cap, and has vacum chambers of burnished copper on each pump.

A second class single engine, with double-acting plunger pump, is constructed to throw two streams, and is fitted with a separate outlet and gate for each of the streams, and also fitted for a connection of suction hose on each side of the engine. It has one steam cylinder and one double-acting vertical plunger pump, and will discharge four hundred gallons of water per minute. The weight of this engine, without any of its supplies, is about forty-eight hundred pounds. It is mounted on high wheels, with easy springs and forelocking carriage, and is fitted with pole and reel for rope, so as to be drawn by men, or with a pole and the appliances necessary for the use of horses. A water-tank, to carry a supply of water for the boilers, makes a part of the engine. It is supplied with two pressure-guages, one to indicate the

pressure of steam, and one to indicate the pressure of water on the hose.

A first-class single engine, with one double-acting plunger pump, is built to throw four streams,and fitted with a separate outlet and gate for each of the streams. It has also a connection for suction-hose on each side of the engine. It has one steam cylinder ten and three-eighth inches in diameter, and one double-acting vertical plunger pump six inches in diameter and twelve-inch stroke. At a fair working speed it will discharge six hundred gallons per minute. The weight is about sixty-five hundred pounds. It is mounted on high wheels, easy springs and forelocking carriage, and is fitted with a self-acting brake, and is constructed for very rapid transit. A tender to carry fuel, and a water-tank for a supply of the boiler, make a part of the machine. The tender will carry fuel sufficient for two hours' consumption,

and the water-tank holds sixty gallons of water. There are two pressure-gauges, one to indicate the pressure of the steam, and the other the pressure of the water on the hose.

There are also second and third class engines with single double-acting plunger pumps. These engines vary only in the dimensions of the parts. The second class machine usually has one steam cylinder eight and a half inches in diameter, and one double-acting vertical plunger pump of four and three quarter inches diameter, and twelve-inch stroke. At a fair working speed it will discharge four hnndred gallons of water per minute. It is built to throw two streams, and is fitted with a separate outlet and gate for each. It has also a connection for suction hose on each side of the engine. The weight is about forty-six hundred pounds. The third class is a lighter engine,

and is built more especially to be drawn by men. It has one steam cylinder seven and three-fourth inches in diameter, and one double-acting vertical plunger pump four and a half inches diameter, and nine-inch stroke. At a fair working speed it will discharge three hundred gallons of water per minute. It is built to throw two streams, and fitted with a separate outlet and gate for each. It has also a connection for suction hose on each side of the engine. The weight of this engine is four thousand pounds.

The *Rotary* engine differs considerably from the reciprocating machine, and is an engine in much favor at many places, and several cities in the United States have "rotaries," exclusively. In this engine the boiler is horizontal and rectangular, forming the bed-rest for the machinery, which consists of a rotary engine and a rotary pump, both on the same shaft. The pump and the

engine are of the elliptical rotary form, and consist of a pair of cog wheels, with longer and shorter teeth alternating, working into each other inside of an elliptical case. Engines with the rotary movement are capable of a high rate of speed, and of dealing with very large quantities of water. No valves are used, and thus a simple and compact form of machinery is secured. Some of these engines perform wonders as hydraulic apparatus, discharging six hundred to one thousand gallons of water per minute. A serious drawback to the earlier rotaries consisted of a larger unbalanced pressure on the journals, and a sacrifice of cut-off and expansion; these defects however have been pretty much overcome and obviated in the machines of more recent manufacture.

A first size rotary is described by its builder thus: The boiler is patent circulating tubular, made of the best quality of

boiler iron, very strong, and covered with Russia iron, or other metal, and surmounted with a brass dome; raises steam from cold water in from five to six minutes. The engine and pump are patent direct acting rotary, with capacity to discharge seven hundred gallons of water per minute, and throws four streams. Forward wheels three feet ten inches high; hind wheels five feet in diameter, made of the best quality wrought iron, with bronze metal hubs. It has a tank for feed water to the boiler, which is kept supplied with water from the main pump. Has a donkey engine and pump for supplying the boiler, which can be used at any time independent of the main engine. Also, a supply pipe leading directly from the main pump into the boiler. Tender in rear of boiler, and also seats in front for driver and engineer; has suction hose attached to the pump, brass strainer and hydrant attached.

Full set of discharge pipes, nozzles, and all the tools necessary to use about the machine; silver-plated signal and hand lanterns, with name and number engraved on the glass. Weight, about six thousand pounds when ready for service. Dimensions, nine feet three inches high; twelve feet six inches long without tongue, and twenty-three feet long with tongue; six feet two inches wide.

A second size discharges six hundred gallons per minute, and will force a one and a half inch stream two hundred feet, or a one and an eighth inch stream two hundred and forty feet, or two one-inch streams two hundred feet, with a steam pressure of not over sixty-five pounds. Weight of machine, light, forty-five hundred pounds. This size has a tank and tender with twenty-five feet of suction, strainer, and hydrant attachment. The wheels are of iron, and of the same diameter as on first class engines. It is equally

balanced on easy springs, and draws as easily as a hand machine. Steam is generated in from five to six minutes, from cold water. The first fire being made of wood, any good quality of bituminous coal may be used. Dimensions, nine feet three inches high, twelve feet six inches long without tongue, twenty-three feet long with horse, and seventeen feet long with hand tongue, six feet two inches wide.

The third or smallest size discharges five hundred gallons per minute, and will force a one and quarter inch stream about two hundred and twenty feet, or a one and an eighth inch stream two hundred and thirty feet, or two three-fourth inch streams one hundred and eighty feet, with a steam pressure of from sixty to sixty-five pounds. Weight of machine, light, thirty-six hundred pounds. This size has a tank and fuel pan, suction hose, discharge pipes, etc., and wheels same

diameter as first size machine. Can be easily drawn by twenty men; does good fire duty through any line of hose under three thousand feet; has no valves or connecting rods. Dimensions, nine feet three inches high, thirteen feet six inches long without, and seventeen feet long with tongue; six feet two inches wide.

The last and least fire extenguishing apparatus is "The Annihilator," which was first brought to public notice by a great American showman about the year 1850. It is made of three sheet iron cylindrical vases, set one within the other; between the two outer ones is placed a quantity of water which may be generated into steam and discharged into the inner cylinder, which contains "a charge" of gas-generating mixture, consisting of chlorate of potash and sugar, placed in close proximity to another charge

of sulphuric acid, enclosed in a small bottle, which, on being broken, both charges chemically unite and inflame, and the gases pass into the water, forming steam and a dense vapor. This vapor, under favorable circumstances, with no fresh currents of air, deadens and extinguishes fire. These machines are considered by many to be useful and handy to have around in cases of incipent fires. Persistent advertising has made them quite popular, and they have doubtless considerable merit. It is claimed for Carbonic Acid Gas that experiments have shown that fire cannot burn in an atmosphere containing one-fifth part of its volume, and that its presence does not injure the finest fabrics, or discolor the most highly polished plate; consequently it does no damage to goods or furniture, which water destroys.

MUSTERS AND TESTS.

SO long as human habitations are combustible there will be earnest rivalry among the men and the methods that are employed to protect them from destruction by fire, and so long as men "run with the machine" to extinguish conflagrations, there will be firemen's musters. If there were any probability that steam would wholly supersede the use of hand-engines, there would still be room for occasional meetings of the firemen for friendly competition. The fireman's pride in his machine is not decreased by the fact that steam supersedes muscular labor, nor is the necessity for his personal prowess lessened in the combat with the destroying element. The excitements would be the same, only the numbers would be less. But there is hardly a prospect of the

disuse of hand-engines just yet, and therefore the old-fashioned muster is still, and must be in the future, a cherished thing, though of less frequent occurrence than formerly.

During the past years musters have been held in various parts of the country, whereat hosts of firemen have gathered, and where scores of hand and steam-engines have had their power and capacities tested; not that these tests show very accurately the whole and real merits of the several engines, but the general results indicate the progress that has been made in the construction of this class of machinery. The engine that is the victor over its competitors one day, may, under the disadvantage of a gust of wind or other cause, be beaten the next day. The total averages of many engines from year to year, however, do indicate the progressing efficiency of the various departments.

At musters and trials it is necessary that "fair-play" should be observed, and the rules and regulations adopted and observed are the same, subject to such slight modifications as varying circumstances may require. It is customary to require each engine to draft its own water and play through 200 feet of leading hose, and play through such pipe and nozzle as they may select. Five minutes are allowed each company after setting their engine, and their best stream within that time is measured by the judges. Two minutes are allowed each company to replace each length of bursted hose. Each company selects a judge to assist during its trial only. Officers of companies see that their engines are ready before their numbers are called by the judges. New 2 1-2 inch hose is furnished for the trial, free to all.

Prizes are usually awarded in amounts of $25.00 to $200.00 to the one or more en-

gines which perform the best playing in horizontal distance. For steamers, the maximum pressure of steam allowed is one hundred pounds.

The principal interest and excitement centres on the exertions of the hand-engine companies. The course played over is roped in, and a board platform for marking the length of the streams laid in the street beyond the first hundred feet. Each company occupy about ten minutes with its three trials; and occasional delays by the bursting of the hose protract the time. Three or four companies are all the while waiting with their machines for their moment of trial, and they jingle the engine-bells as a notice, "All Ready!" A big card designates the number of each company, as its turn arrives. One after another they push up and unlimber beside the huge cistern, which a steam fire-engine keeps full all the time. The

brakes and the hose are attached in two minutes. Three or four men mount the machine, each gets one foot upon the crank, the men grasp the brakes, and the foreman commands a slow movement. The leading hose fills, and a stream broken with explosions of the air from the cylinders spurts towards the marking place. Then the band plays, and the excitement commences. The men work faster, and the foreman begins to shout. The stream turns to spray farther and farther up the street, and the vein in the mud swells and stretches and straightens with the force of the flood it compresses. "Now, why don't you put 'er down? Down with her! Now, now, ya-a-a-ah!" and the thing is done, the band stops playing, the foreman jumps down into the mud, and the engine is limbered up and moves off. This operation is performed as many times as there are engines to test. Steamer trials

are prosecuted under similar circumstances, but with a less number of men, and with less interest to the spectators.

Musters have their uses in that they permit firemen of divers localities to become acquainted, and to compare notes as to the respective merits of their fire-extinguishing apparatus. But it is very seldom that the result of tests wholly satisfies a majority of the contestants, and the "bully machines" are not always rated as "A 1," except by the comparatively few who have put the things through. The victors are elated and satisfied, but the defeated parties are not convinced of the inferiority of their vanquished "tubs." No doubt the most effective engines are those which perform the best and do the most real work during their use at fires, and that is what no fancy tests fully determine.

LURID LEAVES.

A GOOD deal of fine writing and speaking, and not a little of the silly and "hifalutin" sort, have been indulged in by newspaper writers and orators, to describe the incidents that abound at conflagrations, and the daring deeds performed by heroic firemen have served as high-flown themes. So long as men build of material that is combustible, there will be occasions for the exercise of "gifts o' gab," and the reporters may continue to take notes.

A full record of all fires, however, has not been made, and probably never will be; for to note and keep such a record would require the system and labor of a regularly organized Bureau, with branches all over the globe. So frequent and numerous are

the "rampages" of the fire-king, that destructive flames are raging, somewhere within the domains of man, during every moment of the year! Even within the limits of the United States, the number of destructive fires which occur aggregate scores during each twenty-four hours of the entire year. Once a "fire-sharp" gentleman, with an inquiring and recording state of mind, attempted to collect and collate a list of the fires which had occurred during the previous twenty-five years, and no fire was included where the loss was less than $1,000. The result was a closely-printed volume of three hundred pages, but the compiler admitted the list to be incomplete.

It is not within the scope of this article to record or refer to the countless number of ash-makers whose achievements have dotted, lighted up, and darkened the past. As representatives of "Great American Fires"

— giants of the ash-makers — the subjoined were models:

A very destructive conflagration visited New York city on the evening of Dec. 16, 1835. It broke out in Merchant Street, in the triangular block formed by Wall, William, and Pearl Streets. The wind was blowing heavily from the north-west, and the weather was so intensely cold as to render the efficient working of the engines impossible. The consequence was that the fire held the mastery throughout the night, spreading with great and destructive rapidity. The fact that the efforts of the firemen were powerless, on account of the almost instantaneous freezing of the water in the engines, and the benumbing effects of the cold, increased the consternation which prevailed among thousands of the agitated multitude who were witnesses of this calamity,—

many of them doomed to stand and see the destruction of their own fortunes without being able to raise a finger for their rescue. To arrest the progress of the flames was at once seen to be impossible, except by blowing up whole blocks of buildings in advance of the fire. But the difficulty was to obtain powder, as none of consequence was allowed in the city. A sufficient supply could not be had short of the Navy Yard; where, also, the mayor had to send for a strong military force to protect property from the swarms of thieves who are always ready to ply their avocation upon such occasions. In all seventeen blocks of buildings, of the largest and most costly description, were totally destroyed. The destruction of goods of every description was immense. Before the gunpowder was used in blowing up buildings, there were many loud reports from explosions of powder and casks of

spirits. During the entire night the scene was one of awful terror and indescribable grandeur. The drought of the season had contributed to the combustibility of the material, and the rapidity with which house after house, range after range of buildings, was wrapped in flames, was astonishing. The wind being high, large flakes of fire were borne whirling aloft through the dark vault of heaven with fearful splendor. From the direction of the wind, the city of Brooklyn was in great danger, and the brands of fire were carried as far as Flatbush, on Long Island. The buildings in Exchange Place having taken fire, the flames soon communicated to the Merchants' Exchange, which had been supposed to be secure from the fire, and where a large amount of goods had been deposited for safety. Before they could be removed, or the tenants of the building remove their private property, the

fire had reached the roof, which, falling in, carried with it the east side of the building. The splendid dome of the Exchange, after sending up volumes of flames for half an hour to an immense height, fell in with a tremendous crash, burying the elegant statue of Hamilton in the ruins. At this time the fire on Pearl Street had reached Hanover Square, which large space of ground was covered with goods, and so rapidly did the fire spread on both sides of the square, that in a short time the goods were all consumed. Marines with fixed bayonets patrolled among these heaps of goods to protect them from thieves. All eyes were fixed upon the vast volumes of dense black smoke rolling away before the wind; flames darting and roaring from the roofs and windows of whole blocks, walls tumbling to the ground, and the firemen worn out by their exertions, and almost discouraged from further efforts, and vainly

striving against the fire, which seemed to mock all human skill and enterprise. For fifteen hours New York was in flames, and a large section, and that the oldest and most wealthy, was laid in ashes. Six hundred buildings were entirely destroyed, and great numbers badly damaged. Loss was estimated at $17,000,000.

Another very disastrous fire occurred July 19, 1845. It originated in a packing-box maker's shop on New Street, the flames from which communicated to an adjoining warehouse containing saltpetre, which exploded, with three terrific shocks, at quarter before four o'clock, carrying away the building and two other warehouses in the vicinity, spreading death in all directions among the firemen on the ground. Some of the fire-engines near the building were shivered to atoms. The three explosions were ac-

companied by shocks resembling earthquakes, and so powerful as to shatter windows within a circuit of a mile. The doors of the American Exchange Bank, in Wall Street, were burst open with a loud crash. The City Bank doors were also burst through, as were the doors of warehouses and buildings in the vicinity. Massive iron doors and window-shutters were bent and twisted in every direction. The explosion not only carried away three buildings, and shattered doors and windows, but it hurled flames and burning timbers into the adjoining warehouses, which caused the fire to rage with intense fury. Thirty or forty valuable stores, with their contents, were destroyed. On Broadway, the splendid hotel known as the Waverley House, with twelve warehouses; Broad Street, — both sides, from Wall Street to Exchange Place, and from thence to Beaver Street. Exchange

Place, — from Broadway to Broad Street, and from Broad to William Street; silk warehouses and dry goods stores were destroyed, forty buildings in all. In Beaver Street a few buildings were on fire, and the firemen worked with the greatest energy to save them. That they succeeded was almost a miracle, for they were already fatigued, and the morning was hot and sultry. The loss of life was great; not less than thirty of the firemen were killed. Loss — $5,000,000.

San Francisco, California, was severely tried by fire May 3, 1851. It originated in a paint-shop on Portsmouth Square, and in five minutes the whole building was in flames, which spread with incredible rapidity to the American House, which, with a furniture store, was on fire before the engines arrived on the spot. The buildings being

constructed of wood, the fire had full sway; the firemen were compelled to fly before the flames in all directions except the north. The three blocks between Dupont and Kearney Streets were reduced to ashes. Besides these, there were thirteen blocks of buildings burned. It was estimated that not less than two thousand five hundred buildings were destroyed. More than three-fourths of the city were nothing but smouldering ruins. Iron and zinc curled up like scorched leaves, and sent forth their brilliant flames of green, blue and yellow tints, mingling with the great red tongues of fire which flashed upwards from a thousand burning buildings. The hills were lighted up as if the sun was above the eastern mountain-tops, and trees, shrubs, herbage, and houses were as distinguishable in the bright light as at noon-day. Darkness hung over a large portion of the shipping where the broad and

heavy smoke lay. People became paralyzed. Every few minutes the earth and air trembled, as great buildings were torn into fragments by explosions of gunpowder; and the air was filled with shattered timber, bricks and mortar. The multitude hung, as it were, upon the borders of this vast sea of flames. Few comparatively knew, or could know, what were the dangers and exertions of those who were within the range of the stifling and scorching flames. In less than nine hours from the beginning, more than twenty squares existed only in memory, and the ascending volumes of smoke and flames which covered the site of the city. But the saddest sight of all was the destruction of brave but bewildered men, who, finding themselves suddenly surrounded by fire, rushed staggering and uncertain from flame to flame, in hopeless efforts to escape, until, strangled and scorched, they writhed and

fell in view of hundreds who were completely powerless to save them. Loss — $17,000,000.

Nov. 10, 1852, Sacramento, California, became subject to King Fire. The fire reached from levee First Street to Tenth Street, presenting one sea of flame, crumbling everything to ashes. An attempt was made to arrest the progress of the flames by blowing up one or two buildings with powder, but it proved ineffectual. The wind had been blowing towards the levee; it increased to a gale, and changed to the north, thus blowing the fire broadside on to that part of the city which was supposed to be safe from the fire, and in five minutes it had spread from M to J Streets. There were not less than two thousand buildings destroyed. The whole city was one mass of

ruins. Ten lives were lost in this conflagration. Loss estimated at $12,000,000.

The city of PHILADELPHIA, Pennsylvania, was visited by a fire July 9, 1850, of appalling magnitude. It started in a large warehouse. Two explosions occurred in the building where the fire originated, rending the walls asunder, and throwing the burning timbers in every direction, by which means the fire was communicated to a large number of houses. The firemen hastened to the scene of destruction, and were soon engaged in combating the flames. The first explosion caused but a little alarm. The firemen worked on; the fire began to spread, and in a short time a startling explosion took place, quickly followed by another, spreading havoc in all directions. Beams of wood, scantling, bricks, metal roofing, and blazing shingles, were thrown into the air, spreading to

a greater extent the flames of the already disastrous conflagration. The scene presented was appalling in the extreme. On the eastern front of the stores, where the last explosion occurred, the rush for life was terrific. Men and boys, firemen and bystanders, rushed away from the conflagration, and as they endeavored to escape from the danger, hundreds rolled over, and trampled upon each other, running and jumping over the large piles of cotton and other goods on the wharves. Many were knocked down as if dead, and hundreds were rushing over their fallen bodies, causing legs and arms to be dreadfully broken, and inflicting wounds of a serious nature. In the fright some were thrown into the Delaware River; while a large number voluntarily jumped in, to shield themselves from the bricks and timbers thrown from the burning stores. Frightful indeed was the loss of life, and

still greater dangers threatened, yet the noble exertions of the firemen continued unabated, excepting when a pause in their perilous labor was required for their safety. At night the scene became still more fearful. The heavens presented a lurid glare, and the light of the conflagration was distinctly seen for thirty miles around. Large volumes of smoke were borne along by the wind, and the alarm-bells were ringing every quarter of an hour, and word was passed from lip to lip that the furious element was sweeping everything before it. Falling walls and blazing buildings were to be seen on all sides. Alleys and streets were crossed by the fire, which for a time seemed to bid defiance to all human efforts. From Camden, on the opposite shore, the scene was truly grand; while the shipping in the docks, which escaped the flames, presented a picturesque appearance. From the State-house

steeple the lurid picture was terribly sublime. The sight of hundreds of families, for squares around the fire, fleeing from their houses at the midnight hour, and removing their furniture upon every species of vehicles, amid the din of a thousand voices, and the roaring and crackling of the forked flames, was a scene that can hardly be described. Not for a moment did the noble and self-sacrificing firemen falter in their duty. Difficulty and dangers appeared but to stimulate their courage, and many of them encountered risks and perils far greater than those connected with the battle-field. The number of persons killed and wounded was about one hundred and fifty-six. Loss — $1,000,000.

The city of PORTLAND, Maine, was devastated by fiery visitation July 4 and 5, 1866, to the extent of more than one-third of its

territory. A sea of flame wheeled and tossed in wild commotion, till twelve thousand people were made houseless and homeless. Upwards of fifteen hundred buildings were burned, including eight churches, four school-houses, and eight hotels; all the banks, insurance offices, and law offices; all the dry goods and shoe and jewelry houses; more than one hundred manufacturing establishments, among which was Brown's sugar-house, eight stories high, and covering more than an acre of ground; the magnificent City Hall, and Wood's marble hotel, unfinished, which could not be replaced for a quarter of a million; the hall and cabinets of the Portland Society of Natural History, the value of which could not well be reckoned in dollars, and other noble piles. Fifteen hundred buildings! Allowing fifty feet frontage for each, they would have formed a line upwards of fourteen miles long! But, by

actual survey, the frontage burnt over was more than seventeen miles in length. It was emphatically a resistless hurricane of destruction that went shrieking through the streets and over the house-tops. Almost from the beginning the mayor and city authorities, the chief engineer and firemen, saw that futile would be any endeavor to stay the devouring element in its course; and the conviction soon came that the only alternative was to fight it on the flanks — drive it across the city in as narrow a vein as possible — and the sooner the better! And yet, rapid as was the work of demolition, it took seventeen hours (from 4 o'clock, P. M., on the 4th of July, till 9 o'clock next morning) before the flames had reached the bound where there was nothing more to burn. Many were the feats of daring performed on that wild night, almost unconsciously to the performers. Men are braver,

cooler than they know. To rush across the steep roofs of lofty buildings, to penetrate forsaken streets, through walls of fire, to rooms where it was surmised living beings were helplessly shut up, to lug kegs of powder to and fro, with the fiery cinders falling around thick as the flakes of a vernal snow-storm, to apply the match to exploding mines in dark cellars and intricate passage-ways, or dodge under cover when the shattered fragments of blown-up buildings were raining around,—these were but common feats, but common experiences. Indeed, as has often been observed, one of the most wonderful features of the great fire was, that no one was killed, no one injured; but in the very recklessness of the people was, to a large degree, their safety. Some eleven hundred business places were consumed, with nearly all their contents, involving a loss in goods, machinery, and fixtures, which

careful figuring from data presented was shown to exceed $7,000,000.

There was emphatically a "Great Fire" in the city of CHICAGO, Illinois, Oct. 9 and 10, 1871. It was claimed to have been one without a parallel in the history of the world, and it would be impossible to make a full statement or record of the circumstances attending it. From investigations made, it was ascertained that the fire originated in a small frame structure located in the rear of No. 137 De Koven Street, used as a cow stable. The fire commenced at about 9 1-2 o'clock, P.M. A strong south-westerly wind was blowing at the time; no rain had fallen for several weeks previous; consequently all combustible matter was prepared for ignition. The origin of the fire could not be definitely arrived at, but, from all the circumstances connected with the case, it was currently

believed to have been set through carelessness. This portion of the city was occupied by the poorer classes, principally Bohemian emigrant families, and being in the vicinity of several planing-mills, shingle-mills, and factories, had collected a large quantity of shavings from these places, and stored them in the basements and yards of their premises for winter fuel. All the apparatus responding to the first alarm, were soon upon the ground, and were placed in the most advantageous positions in very quick order; the second and third alarms were given in succession, almost instantaneously, bringing the entire department to the rescue, but of little avail. Considering the difficulties the department had to encounter on that dreadful night, with few exceptions, the officers and men worked with a will and energy seldom seen. They had just passed through a severe fire twenty-four hours previous, and part of

the companies had left the scene of the Saturday night fire but a few hours, when they were again called, tired and worn out from hours of hard labor, to this one, still more fearful than the one they had just dealt with. While the department were working on the original fire, which was surrounded and under control, a fearful gale which was blowing at that time carried not only sparks, but brands and pieces of boards on fire, the distance of two to four blocks. To the surprise of the firemen, they were informed that a church over two blocks to the north was on fire. A new base of operations was then formed, to protect the property around the burning church. While thus engaged, they were again informed that a fire had broken out in a match factory, a lumber yard, and a shingle mill. People living in the vicinity had carried out bedding, furniture, etc., into the streets and alleys for safety, which were

soon all ablaze, the strong wind carrying the burning material to the east side of Canal Street, communicating the fire to the wooden structures on that side of the street. These buildings being elevated to the height of five to seven feet above the ground, formed a complete tunnel, and the draft carried the flames for a whole square, without meeting even the resistance of a common board partition. In the meantime the heat drove the firemen, and they were compelled to remove some of their apparatus, which occupied quite a length of time, also losing considerable hose. During this time the fire made fearful progress; so rapidly did it advance, that it was impossible to concentrate the apparatus at any one point of attack. Some of them were badly burned, and one of the engines was entirely consumed. Large brands of fire were carried through the air for miles, alighting on the roofs of buildings

in the business portion of the city. Three different times was the cupola of the Court House, at least one mile distant, on fire, and it required the efforts of the watchman and others to extinguish it, and keep it from destruction at that time. In the short space of one hour and fifteen minutes, the fire had reduced thirty-two blocks of buildings to ashes, covering an area of eighty acres, and incurring a loss of about $1,475,000. At this time information was received that the fire had crossed the river to the South Division, and was burning in the vicinity of the gas-works. A portion of the department was ordered to the new field of action, and on its arrival there were found not only several buildings on fire, but the largest portion of the two squares. So rapidly did the fire spread, that the wooden buildings on Quincy Street, the Armory Building, the square known as "Conley's Patch" (all composed of wooden

shells), the gas-works, and the roofing material yard were one sheet of flame in a short time. Through the agency of the burning of these premises, large firebrands, composed of tar and pitch felting some two or three feet in length, were whirled through the air for several blocks, and would alight on some building, and hardly a minute would elapse before the whole structure would be involved in one mass of fire, thus starting in different parts of the city what might be called different fires, and all burning at the same time. A greater portion of the department was ordered to the south side, but it was of little avail, the wind blowing so fresh at this time as to cut a solid stream of water into spray, before it had gone the distance of twenty feet from the pipe. The fire made such rapid headway, that the engines were moved often to save them from destruction; consequently large quantities of hose were

abandoned and lost; — so much so, that there was soon a short supply. Soon it was discovered that the large building known as the Oriental Block was on fire in the rear. In a few minutes the entire block was wrapped in flames. The next to be seized was the Court House and Chamber of Commerce buildings, which were very soon destroyed. Shortly after this (about half-past two o'clock in the morning) intelligence was received that the water works were on fire, then one mile north of the main body of the fire. This fact convinced the fire marshal that it would be impossible to stay the flames in front. The apparatus not then engaged along the south line of the fire was ordered along the river and its branches, to obtain water and fight the flames on the flanks, expecting to change its course towards the lake, and succeeded, in a measure, to do so, until the wind changed to a northerly direc-

tion, bringing fire and destruction with it. At about ten o'clock, A.M., on the 10th, engines arrived from Milwaukee, and were at work in a few minutes. By their aid, the fire was kept from crossing to the west side of the river along the north branch, and a portion of the buildings in the North Division were saved, by the great exertions of the department and citizens. In many instances where the engines endeavored to obtain water from the river, especially along the main and south branch, the ends of the streets were occupied for business purposes, and much time was lost in removing obstacles, to gain access to the river to take suction. Between one and two o'clock Tuesday morning, the 11th, the fire had spent its fury. A lull of the wind, and a slight rain, had commenced to fall, aiding greatly in the work of preventing its further progress, which had then extended to the extreme

northern suburbs of the city. Thus, within the space of twenty-eight hours, had the flames destroyed about 25,000 buildings, covering an area of 21,000 acres. The number of lives lost was nearly 300, and the number of people rendered homeless was 100,000. The value of the buildings destroyed was equal to those saved; so that, in fact, the leading city of the West was literally half wiped out. Engines and other fire apparatus were present from Milwaukee, Wis., Cincinnati, Ohio, Pittsburg, Penn., New York, Detroit, Mich., Alleghany City, Penn., Freeport, Ill., Aurora, Ill., Quincy, Ill., Bloomington, Ill., Springfield, Ill., and Louisville, Ky. Much valuable property was saved by their timely arrival. The officers, and men accompanying them, were untiring in their endeavors to save property and render assistance. The total loss approximated to $190,526,500;

insurance on the same, $90,000,000; loss over insurance, $100,526,500.

Another conflagration laid in ashes a considerable part of CHICAGO, Illinois, on the night of July 14, 1874. The fire broke out at 5 1-2 P.M. in the rear of No. 527 South Clark Street, near the corner of Second Street, in a locality where wooden buildings of the flimsiest order was the rule, and it did not take long to fan the incipient blaze into a terrible conflagration. A second, third, and general alarm followed rapidly, and soon the entire Fire Department was at work. A stiff gale was blowing from the south-west, and the flames swept steadily on, hedged in on either side by the efforts of the firemen, but were utterly resistless in their awful march towards the lake and river. Taking a diagonal course in a north-easterly direction, the fire burned a clean swath of

about a block wide from Clark Street, across Fourth and Third Avenues, striking State Street at Eldredge Court, mowing down the Continental Hotel like a reed, and then widening out towards the north, and sweeping on across Wabash Avenue, destroying the splendid First Baptist Church, near the corner of Hubbard Court, and also consuming the Jewish Synagogue, corner of Peck Court. At one time it seemed as if the fire would sweep through Michigan Avenue, and, being hemmed in on either side by the firemen, would die out for lack of something to feed upon; but while the Baptist Church was wrapped in flames, and the firemen were exerting themselves to their utmost to keep the fire within the limits to which it seemed to have chosen, the wind veered and blew strong from the south, changing the direction of the fire, and turning the flames toward a harvest of splendid

buildings erected after the great fire of 1871, on Wabash Avenue, State and Clark Streets, and Michigan Avenue. In a moment the flames leaped across that street, and the Post Office was a mass of flame before the awed multitude could realize the extent of the new danger. At the same moment the flames sprang up again at State Street, and, fanned by the wind, swept northward, until, from State to Wabash Avenue, an awful avalanche of fire rolled onward towards the wealthy business centre of the seemingly fated city. After crossing Harrison Street and devouring the Post Office, and buildings to the north, the angry flames leaped across Congress, and the great Adelphi Theatre soon crumbled into dust. The Davis Sewing Machine Building, corner of Harrison Street and Wabash Avenue, and several stately neighbors, also proved fuel for the flames. Both sides of Wabash Avenue,

from Eldridge Court to Congress Street, with now and then the exception of a building, were burned to the ground, and a portion of State Street was laid in ruins. In all, about 1,000 buildings were consumed, but a very large proportion were mere rookeries of the flimsiest description, whose destruction involved comparatively little loss. Some sixty acres were burned over, comprising fifteen squares, mostly lying west of State Street, and yet the loss fell principally on the east side of that street, where were located all the valuable buildings burned. The track of the flames was about half a mile long, and about a quarter of a mile wide. The fire was got under control about 2 o'clock on the morning of the 15th. The loss of life was about twenty, and the value of property destroyed about $5,000,000.

As a fitting close to these "Lurid Leaves,"

the fire in Boston, Massachusetts, November 9 and 10, 1872, may now be recorded. The compiler of this volume was present on that occasion, and he took part, as a volunteer, in the unequal contest against the red-handed giant of Destruction; and although he had previously served as a fireman during a period of more than a quarter of a century, he never before witnessed such an extensive and appalling display of the Fire-Fiend let loose. No amount of pen-sketching would half tell the story of that occasion, nor is it given to mortal tongue or pen to express the emotions and feelings which fill the soul and the senses when such manifestations of "great light" and "fervent heat" are presented. A host of ready writers attempted the story of the Boston Fire, and many of the narratives were fine and truthful in their descriptive elaborations; but it is not possible to pen-portray, except partially, the

lurid scene, and many of the incidents must ever remain unwritten. The commercial capital of New England scarred and blasted in a single night to the extent of nearly one-sixth of its territory, and the complete annihilation of nearly a thousand massive warehouses, constituted a scene which were enough to cause the hand of the strongest to falter, the brain of the steadiest to whirl, and the heart of the bravest to fail. It was an occasion which emphasized the Scripture truth, "Riches take unto themselves wings and fly away." But the fire, though a terribly severe one to insurance offices, and to many men of wealth and business, was not so immediate and pointed with evil and distress to the poor. There were but few families turned or burned out of house and home, the fire being mostly in "the heart of business." The sudden "shrinkage of values," and the rapid waste of stored

wealth, was, however, sublime and sad to witness and contemplate. There was, during a period of several hours, a continuous destruction of property at the rate of $100,000 per minute. The fire was first seen at about 7-10 on Saturday evening, Nov. 9th, 1872, and the first alarm was sounded at 7-24, which was soon followed by several alarms. The weather, at the time, was clear and cool, the wind being from north-west by north, and blowing with a velocity of five to nine miles per hour. The fire originated in a building numbered 83 and 85 Summer Street, corner of Kingston Street, starting in the rear basement, where there was a stationary steam-engine used for hoisting purposes. The fire undoubtedly took from coals withdrawn from the furnace, and the flames passed with great rapidity through the elevator to the upper stories. The building, though it had been

considered a first-class stone structure, was very soon a vast roaring mass of fire, the granite crumbling as if it were chalk. Some delay to the firemen was caused by a lack of horses, as, at the time, nearly all the animals were sick. Hose No. 2, and Steamer No. 7, were seasonably present, but the other apparatus were delayed from their schedule time three to forty minutes. These lost moments probably cost millions of dollars. There was also a lack of water; the old pipes being too small to furnish the needed quantity. But the courage and devotion of the firemen were sublime; no battle-field ever witnessed nobler heroism than was manifested on that occasion, and numbers of the firemen were literally "faithful unto death." The fire very soon extended from its original starting-point to the high buildings in the immediate vicinity, the flames feeding fiercely on the Mansard roofs.

The fire streaked along the wooden coverings with startling rapidity, and in a brief time there were miles of the aerial fuse in destructive operation. From block to block, from street to street, on flew the fiend-like element till it became master of the situation. But the firemen contested with almost superhuman efforts, and they did all that could be done, under the circumstances, to stay the onward and victorious march of the rampaging ash-maker. In all directions save one did the fire spread, till acres of warehouses, filled with merchandise, were seething and roaring like a Satanic blast-furnace. The miniature lumber-yards, which composed the upper stories of many of the buildings, seemed to "fraternize" with the fiery visitor with wonderful facility, and the great height of the structures prevented the firemen from bringing their streams effectively to bear. The conflagration spread

up Summer Street to Washington Street, on the west, and down Summer Street to the harbor, on the east, and across Winthrop Square, High, Channing, Franklin, Milk, Water, Hawes, Lindall, and other streets, to State Street, on the north, where it was stopped. Nearly all the streets enumerated, except State Street, were put into ruins, as were also the longitudinally located streets of Hawley, Devonshire, Federal, Pearl, Oliver, Congress, Kilby, and several others. All night long the destruction went forward, thwarting all efforts to stop it. The scenes and incidents on the occasion were similar, with various interesting modifications, to those detailed in previous "lurid leaves" respecting other large fires. The firemen were driven from point to point, and the vast crowd of lookers-on gave vent to their voluntary suggestions how to manage the fire. Officious personages meddled, and toted gun-

powder around in a manner that hindered the firemen; and waiting from time to time for buildings in the presumed path of the fire to be toppled down by the powder, did vastly more harm than good.

A good deal of interfering with the Chief Engineer was done by officials and others, who wanted to have "this" and "that" tried with powder; and several attempts were made in their mode of heading off the fire, without avail. In fact the Chief made his greatest mistake in omitting to lock up a score of well-meaning, though injudicious persons, who thought they knew best how to stay the fiery tide. The firemen kept on fighting the flames, retreating and returning, fighting at points all along the fire's flanks, till they finally narrowed the swath of destruction to the Merchants Exchange Building, on State Street, where the fire was stopped.

The result of the eighteen hours of fire-

sway was the destruction of 776 buildings, valued at $13,500,000, together with merchandise and other property of an estimated value of $60,000,000 more. The territory in ruins embraced sixty-five acres. The number of lives lost was about 100. There were present as helpers, on the occasion of the fire, thirty-one engine, hose, and ladder companies, with their apparatus, from other cities and towns. An investigation into the management of the fire was had, which showed that the fire apparatus and the water supply were insufficient for such an extensive conflagration. The Investigating Committee heard a vast mass of testimony on the subject, which was printed, forming a volume of several hundred pages. A change in the fire system of the city followed, control of the Fire Department passing from the Chief Engineer to a Board of Commissioners.

SKETCHES.

Fires may be Lessened.

ALMOST every day, even in summer months, when stores and warehouses and factories are not heated by fuel, and when neither gas nor oil is burned in the majority of them, the record of destructive fires presents before the public of the United States the fullest proof of the carelessness and recklessness of our population in neglecting to take necessary precautions in regard to the origin of these conflagrations. The loss which this country sustains every year by fires is enormous. Wealth cannot be accumulated, and capital increased, so long as property is burned at the rate of $200,000,000 annually. That amount alone would be a very handsome addition per annum to the

capital of the United States. The great secret of the destructiveness of fires is the rate at which they are allowed to spread, even in cities with a good fire department, before the arrival of the engines and the turning on of the water. Fire extends in more than geometrical progression. The first spark could be easily extinguished. Even after it has blazed up freely for several minutes, it might be readily quenched. When, however, fifteen or twenty minutes have elapsed, it has got sufficient hold to resist all efforts to control it, until it has, perhaps, burned down an entire block, or more. In cities it is a very usual thing for the police, on discovering a fire, to break open the premises before the fire-engines arrive. The police have as yet no means at hand that they can effectually employ to extinguish the flames. The opening of the several doors and windows fans the smouldering fire into

full blaze; and if there is not a speedy destruction of the entire building, it is not the fault of the police. Next to pouring water on a fire, the best thing to do is to keep it smothered and confined. So long as it is not well fed by air, it will not extend itself very rapidly. Cannot the police of cities be taught not to open either door or window of any burning building until the firemen do this, when they are prepared to drown the flames with water? Even the firemen ought to open but as few passages for the air as possible. In all large establishments, where a watchman is kept on the premises at night, there ought to be means of extinguishing fire, ready at hand, on every floor. There are many places in large cities where the watchman has not even a bucket of water convenient to cast on the first spot that might catch fire. While he sounds the alarm, and the firemen are get-

ting to the place, the work of destruction proceeds, and by the time the water is turned on the premises are past being saved. Why not have a supply of full buckets of water on each floor, in all extensive premises, to be used on the first sign of fire? Where a water supply for extinguishing fires can be carried through large buildings, with hose on each floor, ready to be attached in an instant, there is no excuse for not taking so very necessary a precaution. The question of expense is not a sufficient plea to raise in a matter of this kind. Three-fourths of all the fires could be snuffed out at starting, if the means were only at hand with which to combat the fire in its origin. During the summer months there ought to be a very general overhauling of the means by which large buildings are heated. When fires are lighted there is a regular run of fires from the usual cause, — "defective stove-pipes."

Every proprietor who does not desire to see his property consumed, ought to look after the heating apparatus during the summer months. At every place where a hot pipe passes too near wood-work, alterations ought to be made so as to give sufficient protection against ignition when stoves, heaters and furnaces are re-lighted.

Godliness is Profitable unto All Things.

For a dozen years or more the Rev. Samuel Scoville has been Pastor of the Congregational Church of Norwich, New York, and he has been personally identified with the firemen of the town, joining them in the first instance as a private, and rising, by faithful service, to the rank of foreman of his company, and at last to that of Chief Engineer of the Fire Department. He always turns out for fires by night or by day, like the rest of the men, wears the same uni-

form, and works with the same energy. It is no secret that he is greatly beloved by his brother firemen, and that his influence among them is very great. For his sake many a man has left off profane swearing, and the use of intoxicating drinks. Mr. Scoville once preached to the firemen in his own church, they filling the pews and he the pulpit, — he and they being in full uniform. He gave the address at the unveiling of the Firemen's Monument in Spring Forest Cemetery, Binghampton, N.Y. These sentences from the concluding passage show what wholesome and earnest spiritual analogies Mr. Scoville finds in the unselfish functions of the fireman's office: "One word more, Brother Firemen: Our shaft points upward; let it be the finger-post to the direction which our feet are treading. I have called you preservers, and you are. This is the very heart of your service, — to save property

and life. Now you know who stands at the head of that line: the Chief Engineer — I speak reverently — of that whole Department of the Preservers, standing forward so prominently in this, that he is called *The Saviour*. I would have, then, that our work should form one bond of union — create one feature of resemblance to him — and find its completeness in the full and perfect work which he is carrying forward in the world; that having stood by him in the putting down all that destroys, we shall share with him the glory of the final triumph."

[It was an irreverent volunteer who yelled, "Bully for you!"]

Fire-Boat.

The annexed is a description of a fire-boat built for the City of Boston, and now in service, and which has proved a valuable auxiliary to the Department: The fire-boat is

about fifty-five tons measurement, and measures seventy-five feet in length, fifteen feet beam, and seven feet in depth. Her hull is built of iron, the keel, stem and stern-posts being of hammered metal; and the frames, which are of reverse angle iron, spread twenty-one inches between centres, are stiffened by vertical floor-plates. Three keelsons extend the entire length of the boat. The forecastle below deck is fitted with berths, table-seats and lockers, for the accommodation of the men. The house on deck has a cabin, engine, boiler, cook and hose-rooms, all of which are finished in a substantial and workmanlike manner. The pilot-house is on top of the main house over the hose-room, and is fitted with seats and mahogany steering-wheel; a hand-rail extends around the house to prevent accident, and the top is covered with tin, to insure safety from fire. The main engine is ver-

tical, direct acting, high pressure, with link motion and independent cut-off valve. Its diameter of cylinder is seventeen inches, and seventeen-inch stroke. The propeller is six feet in diameter, with five inch wrought-iron shaft; two force-pumps driven from the main shaft, and one steam-pump for feeding the boiler, and a steam siphon-pump for the bilge. The boiler is an upright tubular with cylindrical fire-box, twenty-four feet grate surface. The whole power of the fire-engine machinery is equal in capacity to four first-class fire-engines, and with all in action will play eight streams at one time.

Hose Elevator and Fire-Escape.

The best apparatus for the above purposes invented up to the time of compiling this volume, consists of a shaft put into or above the cornice of the building, secured by iron

beams to the roof timbers. On this shaft is a drum, upon which is wound a pliable wire ladder composed of twelve wire cables, each one-eighth of an inch in diameter, and steps of flat band iron one-eighth of an inch thick, one and one-sixteenth of an inch wide, and twenty inches in length. Inside of the ladder-drum is a pulley through which passes a stout wire cable, one end having a hook and snatch-block attached, the other end a hook only. These hooks, before the ladder is wound up, are fastened to the bottom step of the ladder. The ladder and hose elevator are wound up together by means of gearing. From the top runs a wire cord to the side-walk, attached to which is a lever controlling the top, and enclosed in a box similar to the fire-alarm box. On discovery of a fire the box is unlocked, the lever pulled, and the ladder and hose elevator rapidly descend to the ground. A weight at the bottom insures

its descent, while the rapidity is regulated by a governor attached to the gearing on the roof. On reaching the ground the ladder is secured firmly to eye-bolts in the pavement, and on the arrival of the Department everything is ready for work. The firemen first go to the roof, or any story, by the ladder, the hooks of the hose elevator are released from the bottom step of the ladder, to one of them is attached the hose, while the other hook is fastened to the hose-carriage. The horse is then driven off, and the hose is thus raised to the desired height, and in less than two minutes after the arrival of the engine the firemen may be on the roof with their hose in full play. The ladder is capable of supporting a weight of from 8,000 to 10,000 pounds, and the cable used for elevating the hose, which may also be used for lowering goods or persons from the windows, will support from 2,000 to 3,000 pounds weight.

Fuel for Steamers.

An important consideration to those maintaining steam fire departments, is the matter of fuel for use in the steamers. That kind of fuel which will weigh the least, occupy the least space, and yet produce the most steam in the least time, is the grand *desideratum*. The following indicates the comparative steam-generating power of various fuels, to convert water at fifty-two degrees into steam at two hundred and twenty degrees, with one pound of fuel:

1 lb. Dry pine wood,	evaporates	3 10 lbs.	water
1 lb. Dry oak,	"	4.85	"
1 lb. English Staffordshire coal,	"	6.04	"
1 lb. Splint coal,	"	6.75	"
1 lb. American Anthracite,	"	7.00	"
1 lb. Coke made in close vessels,	"	7.70	"
1 lb. Newcastle coal,	"	7.90	"
1 lb. Best Wallsend,	"	8.60	"
1 lb. Cumberland,	"	10.00	"

It is claimed that a superior fuel for a steam-generator is obtained by mixing two

tons of Cumberland with three tons of Anthracite.

A Model Engine-House.

In Nashua, N.H., there is an engine-house which is one of the largest, most convenient, and substantial buildings of the kind in the State. The architecture is a modern improvement on the old Norman and Gothic, and, from the location, serves the double purpose of being ornamental and useful. The house has a front 50 feet 8 inches, a depth of 70 feet on the main building, and 44 feet on the stable, with sheds for city carts, etc., at right angles. It covers, with the yards and driveways, an entire square, and is, therefore, easy of access from any given point. The height of the first story is 13 feet 5 inches, the second story 11 feet. The tower is 60 feet to the bell deck, and 100 feet to the spire. The arrangement of

the lower story furnishes ample accommodations for the entire fire department of the city, and is sufficiently large for an addition of two more steam fire-engines and a hook and ladder carriage, should the growth of the city in the next century require it. The second story is conveniently divided into sleeping-rooms, engineers' headquarters, bath and wash-rooms, and a hall 47 by 26 feet.

A Fugitive all Ablaze.

A man was recently arrested at Sutton, P. Q., for fraudulent transactions in the United States, and was brought before a magistrate there, and held until the proper papers under the Ashburton Treaty could be prepared. He was taken into a hotel for dinner, and as he went in, with the United States detective on one side, and the Canadian officer, in whose charge he was, on the other, two or three acquaintances whispered

to him. The United States officer cautioned the Canadian officer against allowing such a thing, but he considered it all right. When they arose from dinner it was proposed that the man be handcuffed, as a precaution, but the Canadian officer said "No, there was no need of it." The prisoner was furnished a cigar, and lit it, and the three went to the front of the hotel, where a carriage was in waiting to convey him to jail. A saddled horse was also standing near at hand; and, as they passed down the steps, the same men again whispered to the prisoner, who immediately darted to the side of the saddled horse, mounted, and was off in a twinkling. A number of horses near at hand were mounted as soon as possible, and, with cries of "Stop thief," a large number joined in the chase. The rogue had a fleet horse, however, and steadily left his pursuers. After about three miles the horse began to

lag, and, as another bad thing, the fugitive's coat appeared on fire, which he was trying hard to put out. He had thrust a cigar, lighted, into his pocket. At the end of the fourth mile another saddled horse was brought out of a piece of woods, but before he could mount it he was captured. He was found to be considerably burned. The Canadian officer placed his prisoner on a horse, and, making him clasp his hands around the animal's neck, handcuffed them there. He also tied his legs together beneath the horse's body, and in this condition marched him into Sutton, where it was suggested that the way of the transgressor is sometimes *hot* as well as hard.

A Look Backward.

At a reunion of firemen held in Boston, 1874, Ex-Mayor Quincy was introduced as a very old mayor, but a very young man.

Mr. Quincy, without fully accepting the flattering remark, said that he remembered that he was once a young man, and, he was proud to add, a member of the Boston Fire Department. He had run with the machine before nine-tenths of those he saw before him were born. He said that the circumstances under which he became a member of the Department were these: During or about the time when a well-known citizen, whose name happened to be the same as his own, was Mayor of the City, occurred the great Beacon Street fire. This event produced the greatest excitement and terror among the people. Previous to this, the old mode of extinguishing fires had been in vogue: namely, by forming lines and passing buckets. Much against the wishes of the old firemen of that day, the City Government procured a new engine, called the "Philadelphia," which was provided with suction as well as leading

hose, and enabled the services of the bucket-holders to be dispensed with. So determined was the conservatism of the veterans, that it was found difficult to enlist men to run the new engine; and in order that, spite of opposition, the experiment of using an improved apparatus might be fairly tried, he, among others, joined the company, which was at length formed, to run the "Philadelphia." Among his experiences in the service he recollected that on one occasion there was a fire near one of the North End wharves, and his company passed down the wharf, between high piles of wood, to get a position to draft water. These piles of wood at length took fire, and for some time there was every prospect that they would be compelled to save their engine by running it overboard, and to get away themselves by boats or by swimming. Finally, however, they conquered the fire. He men-

tioned this partly because it suggested to him a significant contrast between the old times and the present, not less significant than the change from hand-buckets to steam fire-engines. At that time nothing but wood was burned for fuel in Boston, and he recollected that his college chum, having made a visit to Baltimore, brought back as curiosities some pieces of anthracite coal, which had just come into use as fuel in that city. These specimens remained on his parlor mantlepiece for a year or more, and were regarded with curious interest.

Rounding a Period.

The Hon. Thomas Corwin, while a member of Congress, on one occasion struck an eloquent note, as follows: "A new man appears upon the stage—a Corsican lieutenant —Napoleon. He ravishes Austria, covers her land with blood, drives the northern

Cæsar from his capital, and sleeps in his palace. The successors of the great Frederick, the drill-sergeant of Europe, are seen flying across the sandy plains that surround their capital, right glad that they escape captivity and death." He then asks how it fares with Russia. "Suddenly we see six hundred thousand armed men marching to Moscow. Blood, slaughter, desolation spread abroad over the land, and finally the conflagration of the old commercial metropolis of Russia closes the retribution. She must pay for her share in the dismemberment of her weak and impotent neighbor. Mr. President, a mind more prone to look for the judgments of Heaven in the doings of men than mine, cannot fail to see, in this, the providence of God." He closes his speech with this splendid sentence: "When Moscow burned it seemed as if the earth was lighted up, that the nations might behold the

scene. As that mighty sea of fire gathered, and heaved, and rolled upward, and yet higher, until its flames licked the stars and fired the whole heavens, it did seem as though the God of Nations was writing in characters of flame on the front of His throne the doom which shall fall upon the strong nation which tramples in scorn upon the weak."

The Chicago Fire Monument.

The location of the monument is in Central Park, the grounds of which comprise 175 acres of land. It has a total height of 125 feet. The base is a Gothic circular arcade, composed of twelve groined arches, resting on a raised platform thirty-six feet in diameter. Height of the arcade to the floor of the terrace, nineteen feet. There are twelve detached columns and twelve three-quarter columns, with caps and bases

of marble, and shafts of polished Scotch granite. The arches between the inner circle of columns are occupied, one by a door opening into an iron staircase, leading to the terrace above; the others, eleven in number, are filled with marble tablets, on which are inscribed the names of cities contributing to the relief of Chicago, and the sums donated, together with other events connected with the destruction and relief of the city. This circular arcade is surrounded by a stone platform ten feet in width, and raised three steps above a concrete walk twenty feet in width. The second story of the monument is a circular shaft, decorated with eight colonnaded arches, containing tablets, also, for inscriptions, and four Gothic porches, one being a door from the stairway on to the terrace, the other windows lighting the interior. The spire of the monument is composed of safes contributed by the Chicago

merchants, the whole terminated by a Gothic column surmounted by a female figure holding aloft, in both hands, a flaming torch, emblematic of destruction by fire.

Fire-proof and Water-proof Floors.

In many conflagrations the fire is largely fed by the wood-work of the floors. The fronts cover a net-work of timber, some of it saturated with resin, and all of it ready to flash from floor to floor with rapidity. A method of constructing fire-proof floors has been developed, giving satisfactory results, consists in spanning the interval between the walls with wrought-iron beams of sufficient strength, and filling the intervals between the beams with low brick arches. It is easy, by observing whether the ceiling consists of a series of parallel arches, to ascertain whether a building is fire-proof or not. Of course no building can be safe which con-

tains substances capable of furnishing their own oxygen, such as fireworks; while the presence of such combustibles as petroleum, which cannot be extinguished by water, but floats merrily along on its surface, is inadmissible. As wood-work must be supplied with air from below to burn readily, a plank-covering can safely be laid upon the more massive foundation. A fire-proof floor can readily be made water-proof as well; and, by a proper arrangement of the staircases, any story could be flooded with water without affecting those below, just as a roof can be flooded without injuring the loft which it covers. Many of the New England cotton-mills are provided with a simple but effective system, which enables any story to be flooded in a moment. An elevated reservoir, of sufficient capacity, is kept constantly filled by suitable pumps, and from this a pipe is led which includes all the mills in its circuit.

The various departments in each establishment are provided with perforated iron pipes extending along the ceiling. These pipes remain empty until a fire is discovered, when the water is turned on, and it is speedily extinguished.

Obeying Orders.

It is usually proper for firemen to obey the orders of their officers, though the following cases illustrate the fact that officers and privates sometimes make mistakes: Once the Fire Department of Chelsea, Mass., had a new chief, who thought he "knew it all," and on occasions of fire he assumed to be a very consequential personage. At one time there was a fire in a wooden block in which there were partition walls of stone and brick. The chief, thinking that things were what they seemed, ordered an axe-man to "knock a hole" through a certain parti-

tion, into an adjoining room, and then he went elsewhere, attending to duty. The man with the axe operated on the wall, and soon got through the sheathing of wood to the stone-work; there he found hard work, but he continued to peg away till he used up several axes, when he desisted. The chief soon made his appearance, and demanded the reason why the professional hole-maker had not complied with the order to put an opening for hose through *that partition?* The reply was, that "the supply-train of axes had not arrived!"

The American Eagle fire company once tried to obey orders under difficulties. One evening an alarm of fire was sounded in the village where the company was located, caused by a great light along the northern sky. The rope of the "Eagle" was immediately manned, and away they went for that fire, under orders from the captain to "get to it, even if it

was out of town." Over hills and through valleys rolled the "Eagle," amid the inspiriting cries of "Now you see it, — wake her up, boys!" After a tug of ten miles or more, with no nearer prospect of getting a stream on that fire, the captain, who "knew a thing or two," and was a wag, withal, commanded a "hold on," and told his men that he guessed the aurora borealis would continue to blaze away in spite of 'em!

The Volunteer Members.

Almost all fire organizations outside of cities where the steam fire engine has not wrought a revolution, there are connected with the regular force numbers of young men who attach themselves to the machine, and affiliate with the regulars, "just for the fun of the thing." These men are designated as "volunteers," "runners," "substitutes," "aids," and sometimes as "benders-on,"

"blowers," or "cracker-and-cheese fellows." Because of youth, or other reasons, these young men do not "jine in" as regulars, though they often take fully as much interest in the success of a favorite machine, and do much to help sustain the reputation of "our crowd" for smartness. They sleep with one eye open, to be early on hand in case of an alarm of fire, and are usually first at the apparatus house. They sometimes make a good deal of noise, and they tug lustily at the bell and drag-ropes. They are ready and anxious to do anything to help run their "bully tub" past that "old box" which is operated by "forty-eleven's company." They are young men of sound lungs and fleet feet, and if there is a little "roughing" to be done they are just the boys to do it. Sometimes they cause trouble to old fogies, bringing on ruptures between the regular organizations; but after the street fun is over,

and the fire is out, they adjourn to the company refreshments with good-will, where they spill the hot coffee and munch crackers and cheese. It is then and there that wonderful stories are told how they ran faster, put on the first stream, got up the first ladder, and done more wonderful things than "old forty-'leven," or any other crowd.

What is Fire-proof Construction?

There appears to be in the minds of most ordinary persons, and indeed of many practical men, a considerable amount of confusion between materials that are incombustible and those which are fire-proof. The former term is applicable to all materials which will not take fire or blaze up when subjected to great heat, or which can never be made to act as additional fuel to the flames, such as stone, brick, concrete, iron, cement, plaster, tile, slate, glass, and several hard woods.

Only a few, however, of these can be properly called fire-proof, or capable of resisting, without change, the action of intense heat. Among the great variety of building-stones, but few can be considered fire-proof. Limestones are readily calcined and converted into quicklime by the action of fire, so that staircases of such material are more dangerous than wooden ones, as they snap off and fall in a mass as soon as the flames touch them. Many flagstones will split to pieces by the action of fire; but there are many good building-stones, called by geologists the "grits," which are capable of withstand- great heat. The grits are the coarse sandstones which may be considered as fire-proof. Granites are not so fire-resisting as their igneous origin would lead one to expect; but they are capable of withstanding a considerable heat unless suddenly acted upon, when hot, by a jet of water. There are sev-

eral kinds of artificial stone made which are more fire-proof than most of the natural stones. Concrete may be considered as an artificial stone, but if made with broken limestone, it will not be fire-proof; the materials used with the cement must be either sandstone pebbles, such as found in gravel, flints, broken brick, or burnt clay. Slates are not by any means fire-proof, as they split to pieces under the action of fire. All the harder kinds of brick and tile may be generally considered as capable of resisting fire when used as walls, or as arched floors; but the softer kinds crumble when highly heated, especially if water touch them. Bricks made of fire-clay are the best that can be used in forming fire-proof structures. Iron becomes so much weakened when highly heated, that it can hardly be looked upon as fire-proof, unless protected by some non-conducting substance; it is found, however,

that solid cast-iron columns will stand heat better than hollow ones, and as they take up less room, they might easily be protected by a coating of cement or other material, without occupying more space than hollow columns of the same strength would do. Cast-iron girders soon give way if heated and then cooled by a jet of water, and wrought-iron beams twist and thrust out or pull down the walls; so that unless well protected, they must never be used in buildings professing to be fire-proof. Although glass cannot be made to take fire, yet it breaks into pieces as soon as the heat reaches it, and liquifies at a moderate temperature. The number of materials for constuction which may be considered fire-proof is very limited, and it depends in a great degree upon the manner in which these are used, whether the building is fire-proof or not. Many of the harder kinds of timber, if used

in large scantling, may be considered as fire-resisting; the effect of heat does not penetrate into the interior of the wood, and only chars the outside; but when timber is cut up into thin slices as joists or rafters, it readily ignites, and adds fuel to the fire. Ordinary dwellings may be rendered sufficiently fire-proof, at moderate expense, by avoiding the use of materials that readily catch fire, such as thin joists and rafters, and light balusters to the staircases; by putting thick joists to carry the floors and pugging between them; by filling up the space under the staircase, between the wooden treads and plaster soffit; by using iron balusters to the stairs; avoiding quarter partitions, or having them bricknogged so as to leave no hollow spaces; by having the floor-boards of wainscot instead of deal, and tongued with iron. But it is not in buildings of this class that the great fires occur, and which can be ren-

dered practically fire-proof without much difficulty or expense, but in the large warehouses covering acres or even miles of ground, and in which thousands of tons of inflammable goods are stored. These buildings require a very different mode of construction, to render them capable of withstanding the tremendous heat that will be generated if a fire occurs in their great rooms. In the first place, the walls of such buildings ought to be made much thicker than is usual; an extra half-brick or whole brick in thickness would not add much to the cost, and would increase the stability to a very great degree. The brickwork should be protected both inside and outside with cement or plaster materials. Concrete would be a better material than brick for the walls of warehouses, and need not be made so thick as would be required for brick walls, being about one-third or one-fourth stronger; it should, however,

have plenty of iron hooping as bond throughout it, so as to prevent settlements and cracks. Concrete should also be used for the staircases and landings, iron hooping or wire being used to prevent risk of fracture, the steps cast in moulds and built into the walls on both sides, and not made to hang over on the outer side. If stone is, however, used for stairs, it should be the hard "grits," and free from laminations. Steps may also be made of fire-clay, terra-cotta, or artificial stone, which are both durable and fire-resisting. For warehouses of large size it is almost impossible to dispense entirely with the use of iron girders to carry the floors; but these must be entirely covered up and protected so as to prevent the fire, should it occur, from touching them. A good way to do this is to lay concrete, a few inches thick, flush with the underside of the girders, and then cover the whole with common plaster;

the floor above can then be laid in any way that is most convenient, as the concrete below will effectually stop any fire from passing through ;— the concrete should have iron hooping or wire bedded in it. If it be found necessary to support the girders in the middle, hollow iron pillars must be avoided, and they may be either of solid cast-iron, or, what would be better, of fire-bricks moulded circular, and built up into a round pillar. If cast-iron is used for the pillars, it should be protected by a covering of fire-brick, concrete, or plaster. The ceiling of the top story should always be made fire-proof, and independent of the roof over it, which may then be made of any ordinary material ; or even if the roof took fire, it would not be communicated to the floor below, provided a fire-proof ceiling intervened. This is a point that cannot be too strongly insisted upon, as it is generally

from the falling in of the roof that the total destruction of the building follows. The iron girders which carry the floors should not be built into the wall, which is weakened by so doing, but rather supported on corbels of fire-brick or hard grit stone; in either plan, however, the ends must be allowed full play, so that in case of any expansion they may not thrust out the walls. When an iron breast-summer is introduced to carry the weight of a wall above, it must be completely protected, as any twisting or yielding in the beam will endanger the superstructure. A casing of timber plastered over would be an effective means of keeping off the heat from the iron. The windows of a warehouse form an important feature, and one that should never be overlooked in considering the action of fire. If all the windows and other openings could be kept closed, a fire occurring in a room would soon burn itself out from want

of a sufficient supply of oxygen; but in most warehouses there are broken squares of glass which will supply air to the flames, and heat up the whole room to the temperature of a blast furnace in a very short time. It is useless to have the frames and sash bars of iron, if the glass is continually being broken. When warehouses are built in separate blocks, but having openings for communication between them, they are fitted with double iron doors, having a space nearly equal to the thickness of the party wall between the two doors. The proper construction of these doors is a very important matter, and the neglect of which has been the cause of many fires extending from block to block, until the whole series are destroyed. If the doors are made of one thickness of wrought-iron, that next the room in which the fire originates soon becomes red hot, and so twisted out of its frame as to allow heat to

the inner door, which in its turn gets twisted, and admits the flames to the next block of buildings. These doors ought each to be made two or three inches thick, and of double sheet iron, filled in with some non-conducting substance; the bolts of the lock should be made to shoot both ways into the frame in three places, and the frame should be built into the wall, at least half a brick back from the face, so that the fire can have no effect upon it. If one of these doors becomes red-hot, even on the inner face, no injury will happen to the other door, beyond the scorching of one side. The heads and sills of these doors should be formed either of hard grit-stone, concrete, fire-brick, or artificial stone. Staircases should always be separated by party walls from the several rooms, and should have iron doors to close the openings from them into the warehouse. All well-holes should be built up solid from bottom to top.

Much has been said about having a good water supply, with hydrants all over the premises, and watchmen always at hand to extinguish the first spark of fire that may be discovered; but it is best to place little confidence in such arrangements, as it almost invariably happens that a fire breaks out when least expected, and when either the water supply has run short, or the watchman has been called away; and, before the appliances can be made use of, the fire has got such a hold on the premises that the engines cannot put it out. With ample means at command, and a variety of material ready to hand, an architect of the present day ought to find but little difficulty in being more than a match for that most destructive of all elements — Fire.

Great Fires of History.

Thus far, the Chicago Fire of 1871 stands about second in magnitude among the destruc-

tive conflagrations recorded in the annals of the world; and modern history hardly furnishes a parallel. In the earlier ages, the destruction of cities by wrathful armies was the work of days. Jerusalem, with its thousands of inhabitants, fell a victim to the flames, and the misery there has been written in words that can never be forgotten. Moscow was burned as one of the strategies of war. In Chicago the loss is placed at $150,000,000, and the number of buildings at nearly 10,000, the value of which severally exceeding the value of those burned at Moscow in a triple ratio. The following are some of the great fires recorded in modern history: London, 1666, 13,200 buildings destroyed; loss, $55,000-000. Moscow, 1812, 30,800 buildings burned; loss, $150,000,000; only 6,000 houses left standing. Savannah, 1820, 463 buildings burned; loss, $8,000,000. New York, 1835, 463 buildings burned; loss, $18,000,000.

Pittsburg, 1845, 1,200 buildings destroyed; loss, $5,000,000. St. Louis, 1848, 418 buildings and 27 steamboats burned; loss, $6,000,000. San Francisco, 1851, 2,500 buildings burned; loss, $17,000,000. Constantinople, 1852, 3,500 buildings burned. Hamburg, 1852, 1,747 buildings burned. Portland, 1866, 1,600 buildings burned; loss above insurance, $5,500,000. Constantinople, 1870, over 7,000 buildings burned; 1,000 lives, and $25,000,000 worth of property lost. Boston, 1872, more than 700 buildings and about $80,000,000 of property destroyed.

It is difficult to decide which was *The Greatest Fire*, for the figures indicate that where the number of buildings destroyed was the largest, the value was less than where fewer in numbers were destroyed at other fires. There are also various other matters properly to be considered, such as

the number of lives lost, and the amount of personal suffering involved.

Fox-Tail Burners.

It is recorded in a reliable book that once upon a time there was some fire-setting done by members of the animal kingdom which have always been considered as wily and instinctively cautious. The narrative, in the original, is quaint and readable, being well worthy of consideration by American Firemen. Without reproducing a detail of the affair here, the points are, substantially, that a son of Manoah, who had been a Judge, on several occasions got mad clear through toward some people who had considerably bothered him, and had made his married life miserable unto him. He was a muscular sort of a man, and was rather furious whenever too much crowded by his enemies. In his palmy days no

ordinary mortal could stand before him in mortal combat, and it is averred of him that on one occasion he slew a thousand men with an ossificated claymore which had once done service as a masticator for a beast of burden. But the more enemies the Judge put *hors de combat*, and the more he stove around, generally, the more he was tormented by those who desired to circumvent and capture him. He had to resort to many expedients to keep his persecutors at bay, and it required all his ingenuity and strength to enable him to hold his own. He wasn't, naturally, a bad man, but things got to such a pass with him that he had to use a good deal of force and fire to get at and keep square with the foes that multiplied at his front, rear and flanks. Finally, his wife turned against him, and married another man, which determined him to try a fire expedient. He caught, somewhere in Tim-

nath, three hundred young foxes; though the historian doesn't very clearly designate how he caught them. These foxes he strung together in pairs by tying together their tails, and to each pair of tails a fire-brand was fastened, when the whole scampering three hundred foxes were let loose in the surrounding fields and vineyards. This occurred at the time of early harvest, when much grain was in "shocks," and which, being dry, took fire, almost at the word "Go" to the foxes. Great destruction ensued, and the staff of life was very considerably shortened to the people. If it was not a burning shame to treat the people so, it must have been, at least, a singeing affair to the foxes, whose bushy tails probably suffered below the bands which bound them. Through the fields of wheat, across the vineyards, among the groves of olives, those four-footed and diminishing-tailed incendiaries went on

a dead run. At the start off, it is likely the quardruped teams were not even, but the pairs soon learned to travel evenly together, and it was not long, probably, before they made the fire fly in streaks. The brands of fire at the tails were constant incentives to hurry-up, and it may well be believed that there was a shocking time among those who saw their shocks of corn in flames. What, finally, became of the foxes is not related; but the presumption is a fair one that they separated pretty soon after those tail bands burnt off. But of the fate of the Judge himself, the narrative leaves us in no doubt. Had he lived in these times, in our free, happy, proud America, he would have been indicted and tried as an incendiary, or for malicious mischief, and he might have "got fifteen years." As it was, he got overwhelmed, and both of his eyes were put out, after which he was hitched to an endless round of duties

in a meal-making mill, all of which failed to get the mad out of him. The last and crushing thing he did was to pull down a building full of people, smashing them and himself to death.

[If fuller information of Judge Samson and his foxes is desired, the book may be procured of any agent of the American Bible Society.]

The "Holly System."

Many who have heard of the "Holly System of Fire Protection" know but little about its *modus operandi;* a sketch of it, therefore, may not be out of place here. The system is in use in quite a number of cities, and in several States. It consists of a series of powerful rotary forcing-pumps, worked by turbine wheels below, driven by water from a reservoir, or by a massive steam-engine, according as circumstances re-

quire. The simplicity of the system is apparent, and experience has shown its economy and efficiency. Its leading feature consists in this, that, independently of what is called a "gravitation supply," whether from an elevated reservoir or a stand-pipe on a lower plane, the mains of a city can be supplied with water in exact proportion to the demand; and in case of a conflagration, a power of propulsion can be given far exceeding in steadiness and degree that attained by other means. By combining, with pumps admirably constructed and arranged, a hydrostatic pressure regulator, the whole is placed under such perfect control that in twenty seconds the pressure can be increased from the ordinary measure, say sixty pounds to the square inch, to double that amount, or even triple, if required; the special advantages claimed for the "system" are — (1.) Dispensing with all locomotive fire-

engines. (2.) A gravitating supply not needed, nor even an artificial reservoir, where a lake or river is at hand. (3.) The water is applied to a fire much more speedily than in any other way, or as soon as a hose can be attached to a hydrant. (4.) The water is thrown more rapidly, and from one-fourth to one-third greater distance than by a steam fire-engine; and the stream is steady, and not exposed to irregularities and failures from the effect of extreme cold or defective machines. (5.) Every building can have within it an effective extinguisher, and every private hydrant and water-cock becomes a fire-engine, effective in proportion to its size. (6.) The propulsion is so great that long hose can be used, even half a mile, with entire success.

A Notable Gathering.

During the autumn of 1874 there assembled in the City of St. Louis, Mo., a large

number of the leading representatives of fire departments from many cities and towns in nearly every State of the Union. The objects of the Convention were to compare notes, discuss the merits of fire-extinguishing apparatus, suggest ways and means to prevent and suppress conflagrations, and, collaterally, elevate the status of firemen. The Convention continued its sessions during several days, and very considerable progress was made. There was, as might have been expected, some diversity of opinion on several minor points, but the discussion embraced a wide range, and the general conclusions arrived at were such as to reflect credit on the Convention. The various systems in use for suppressing fires were explained, and their defects were pointed out, with strong recommendations that reforms should be adopted where needed. The impression prevailed, and opinions were so expressed, that in many of the larger cities

the water supply is inadequate, in some instances because of the street water-mains being too small. The too common custom of imperfectly constructing buildings, making them dangerous in case of fire, was also strongly reprobated, and the passage of effective building laws in the several States was unanimously recommended. The objects of the Convention were certainly praiseworthy and important, the entire deliberations were harmonious and creditable, and the results were such that much good will doubtless come therefrom to the whole country.

Firemen's Literature.

The host of papers which have been started, professedly in the interest of firemen, have not flourished, but most of them have proved very weak and ephemeral affairs. The "Journals," "Advocates," "Owns," "Trumpets," and numerous other "Organs" which

have heretofore flashed forth in various American cities, have nearly all gone up in smoke, or ended in ashes. The difficulty in establishing a periodical devoted exclusively to firemen seems to be a radical one, for no great amount of patronage has yet been obtainable in this country to sustain any form of mere clannism. Then, again, the usual manner of writing for firemen, as if they were not men, has tended to produce disgust. In fact, the "Mose" and "Syksey" style of literature has contributed much to the "killing" of many would-be organs; and the universal verdict has been, "Served them about right."

There have been but few instances where literature for firemen has taken the book form, and even in those cases the style of the matter was one-sided and exaggerated, or else too intensely local in its character. The editors and authors seem to have had the

idea that firemen, as a class, are not like other men in their tastes for decent English and ordinary common sense. The delusion, however, has been a costly one, and it is probable that, in due time, observation and experience will do their perfect work in undeceiving those quill-drivers who indulge in that play-away style which produces a sort of reading which is not born of fire or good sense.

Fire from the Sky.

On Sunday evening, October 8th, 1871, the village of Peshtigo, Michigan, was visited by fire, and history has never furnished a parallel of its terrible destructiveness. Shortly after the church-going people had returned from the evening service, an ominous sound was heard, like the distant roar of the sea, or of a coming storm. This increased in intensity, and soon the inhabitants became

alarmed, and apprehensive of coming danger. Balls of fire were observed to fall like meteors in different parts of the town, igniting whatever they came in contact with. By this time the whole population were thoroughly aroused and alarmed, and caught up their children, and what valuables they could hastily seize, and began to flee for places of safety. Now a bright light appeared in the southwest horizon, gradually increasing till the heavens were aglow with light. But a few moments elapsed after this before a horrible tornado of fire came upon the people, and enveloped them in flame, smoke, burning sand and cinders. Those who had not reached the river, or some other place of safety, were suffocated and burned to a cinder before they could advance a half dozen steps further. It seemed as if the love of God had been withdrawn from the place, and the fiery fiends of hell had been loosened to wantonly

vex and torment the people. It was the destruction of Sodom re-enacted. The character of this fire was unlike any described before. It was a flame fanned by a hurricane, and accompanied with various electrical phenomena. Those who survived the terrible ordeal said that they received electrical shocks, while they saw electrical flames flash in the air and dance over the surface of the earth around them. But the fury of the flash was past in half an hour, though the fire continued to burn more or less fiercely during the whole night. The full effects of the storm were not apparent until daylight returned, and the survivors could come forth from their retreats. A party of one hundred and fifty fortunately ran together upon a low meadow, and all were saved. A family of five persons saved themselves by jumping into a shallow well; another family of the same number were all suffocated by a like

resort. A large number threw themselves into a mill-pond, and sustained themselves by clinging to the boom and floating logs, at the same time continually wetting the head to prevent it from roasting. Many children, some only one month old, were in the water the whole night, and yet survived. Some who were too ill to walk were taken from their beds and thrown into the water. A large number were drowned, some by being trampled upon or thrown off from their feet by the cattle and horses that, maddened by the fire, rushed into the water. The tornado came from the southwest, and swept over a track of country eight or ten miles in width, and of equal length. The timber, in its course, was felled by the wind and burned by the fire, and every vestige of fence and building were swept away. Sometimes the wind struck the earth with such force that the small undergrowth was torn up and

hurled into winrows, while at other times it would skip away from the earth. The whole population of Peshtigo Village and of the farm lands in its vicinity was two thousand, and fully one-third of those perished on that fearful night. On the east shore of the bay the loss of life was as great as at Peshtigo, making the entire loss of life reach the fearfully large number of twelve hundred.

A Novel Contrivance.

One of the greatest obstacles that fire departments have had to contend against in extinguishing fires in large mercantile houses has been iron shutters, which obstinately refuse to be opened from the outside, even with the aid of axes and sledge-hammers. But it would seem that there is hardly a limit to inventive genius; for an iron shutter has been invented which perfectly answers all the requirements of a fire-proof protection

to a window, and yet may be readily opened by means of a stream of water from a hose nozzle. The fastening attachment to the shutter consists of an iron bar catching in a latch in the usual way, but having a fan-like trigger on the outside, which, on being acted upon by a stream of water, loosens the latch and lets the bar fall at one end. In falling it traverses an inclined plane, and throws the shutter wide open.

Step by Step.

No branch of a fire department is more important to the service than the ladder adjunct; for no matter how freely water may run, it can do but little good in quenching fires unless it be seasonably and directly applied. Even where the most powerful engines are in service, the use of ladders is necessary to aid in reaching the Mansards and upper stories of the high buildings, which

have of late years been put up. In fact there can hardly be an effective department without ladders, and efficient men to handle them; for to put up a single or double-"spliced" requires a plenty of trained muscle and the best of judgment. It is a continual marvel to outsiders to observe how quickly, and seemingly how easily, the American ladder-men elevate their heavy 80 or 100-footers. If they were not active, strong, experienced and intelligent they couldn't do such rearing feats. The Hook and Ladder-men are the Sappers and Miners of the fire departments, and they are as necessary as in an army. Without them the "devouring element" would produce many more surprises and oftener steal a march, which would require harder fighting along more extended lines. But, as yet, the ladder system is not perfect, and there is still room for improvement in the construction of

ladders, for only a few combine the essential requisites of length, strength and lightness. Though rather cumbersome, the Skinner truck and ladder, probably, constitutes one of the best things yet devised with which to take step by step upwards.

Fire and Water-proof Fabrics.

There have been manufactured a few flexible articles, such as handkerchiefs and gloves, which are perfectly fire-proof, made of a laminated mineral substance, known as Asbestos. But the quantity of that material is too small to furnish other than a few articles of novelty; to *wash* such goods it is only necessary to put them into the fire, and there let them remain until the dirt burns off. For the purpose of making cotton cloth nearly incombustible, it is only necessary to mix with the starch which enters into the composition of the fabric, half its weight of

carbonate of lime, otherwise known as Spanish chalk. Another process is to expose cloth for a time to the vapor of burning sulphur, making it so nearly fire-proof that when held over a spirit lamp it will not in inflame, but merely become charred and brittle. It is claimed for both these processes that they effectually accomplish their purpose, without in any way injuring either the quality or appearance of the goods. The incombustible fabric has, of course, an important advantage in the safety which it affords to the wearer. It has also been found that cotton or linen fabrics may be made water-proof by passing them rapidly through a sulphuric acid bath, and then through very cold water, after which they must be thoroughly washed. They should remain in contact with the acid not longer than from ten seconds to two minutes, according to the nature of the goods. The acid has the effect of forming a varnish-like matter, which not only ren-

ders the fabric water-proof but adds materially to its strength, the process being made still more effectual by hot pressing and calendering.

Wood is made non-combustible if soaked for twenty-four hours in a solution of one part of silicate of potassa in three parts of pure water, and after being dried for several days, it is again soaked in this liquid, and again dried; then painted with a mixture of one part of cement and four parts of the liquid described. Three such coats of paint are to be put on, each being thoroughly dried. The paint should not be prepared in large quantities at once, as it soon becomes dry and hard. Wood thus treated is not only incombustible, but will not decay underground.

The Firemen's Lot and Monument at Greenwood.

The New York City Fire Department has a very finely located lot on Tulip Hill, in

Greenwood Cemetery, for the interment and commeration of those members of the department who loose their lives while in the discharge of their unselfish and patriotic duty. The monument is a pyramidal column of marble, resting on a massive pedestal of the same material, with a granite base, and the figure of a fireman on its summit is well executed. One arm surrounds and supports a child, just rescued from the flame which seems still to pursue it. His right holds a trumpet. The attitude is spirited, and the general effect very good. Upon four of the pilasters of the pedestal, and upon its upper surface appear various representations in relief, or in full, of implements and articles appertaining to the fireman's calling. His swinging engine lantern, his trumpet and cap, his hose and hydrant, the hook and ladder, may all be seen in the sculpture. The workmanship of the structure is admirable, its position is commanding and

beautiful. From the loftiest height of beautiful grounds the structure rises, severe in beauty and grand in proportions. It is emblematical of the men and their works, being a perpetual remembrance of them and of their inappreciable services, and it will, probably, stand for ages, the fit expression of gratitude and of their glory. The monument is surrounded by a neat and appropriate iron railing. On each side of the gate or entrance to the plot is a hydrant, and on the top of the railing, at different points, are lamps. In happy unison with the immediate scene, and with thoughts it naturally suggests, may be seen through the leafy openings several churches in the distance. On the tablet at the base of the column, and facing a lakelet is the following inscription :

THE FIRE DEPARTMENT
OF THE CITY OF NEW YORK
HAVE CAUSED
This Monument to be erected,
IN MEMORY OF
THEIR COMPANIONS WHO PERISHED
IN DISCHARGE OF THEIR DUTY,
A. D., 1848.

"*Send along the Water.*"

Somebody has remarked that American firemen are "great on reels," in allusion to the fact that many of the hose carriages are the finest specimens of fire-apparatus in the world. Nowhere else do they elaborate on the make-up, nor so profusely ornament their hose carriages, as in the United States. These "spools" often vie in beauty with the finest parlor furniture, sometimes being emblazoned all over with silver, gold, and choice artistic gems. No wonder that such apparatus are the pride of the possessors, for things of beauty are joys forever, even if they are hose carts. Within a few years the hose carriages have also been much improved as respects to lightness, strength, gearing, and general utility, so that now a thousand feet of hose may be carried with more ease and celerity than one-quarter of the quantity

was conveyed on the old "tenders," which were formerly hitched on the fire engines. Except in the larger cities, where the hose carriages are drawn by horses, the hosemen haul the carriages themselves, and they usually make such good time that the engines do not have to wait, and it is seldom necessary to notify the pipe-men to "look out for your water," for they are always ready. The better classes of hose carriages and hose men are so nearly perfect for the purposes they serve, as to leave but little to be desired.

Fountains.

The remains of the water works of ancient Rome, as described by travellers, excite wonder. Its nine great aqueducts had a total length of 255 miles, and a capacity of daily discharge equal to fifty million cubic feet, yet the water was not conveyed at such height as to produce fountains of extraor-

dinary altitude. The most remarkable ornamental fountains are of modern construction. At Versailles, France, a *jet d'eau* rises to the height of 90 feet, and another at St. Cloud to 160 feet. The Peterkoff fountain in Russia is 120 feet, and the Chatsworth in England is said to be 267 feet high. The altitude of the Chatsworth-reservoir being only 381 feet, the statement of the height of its water jet is too great, unless the water acquires a velocity near that due to its whole descent before reaching the discharging orifice. It is generally supposed that the law illustrated by the inverted siphon is applicable to fountains, and that they would rise to the level of their respective reservoirs, were they not impeded by friction at the orifice and through the air, and, in the case of vertical jets, by the weight of the descending water. Some experiments seem to indicate that the height of jets rising from water under pressure, but almost motionless,

are to each other as the square roots of the heights of their reservoirs. Taking an experiment in which a reservoir 133.4 feet high gave a jet of 100 feet as the standard, the Chatsworth fountain would have an altitude of 170 feet instead of 267 feet, while that from a reservoir 900 feet high would be 261 feet. In nearly all American cities, where water has been introduced from localities having higher levels, are fountains, which, at times, are allowed to "play away" for show and display. They certainly constitute very pretty sights while the sunbeams blend with them, presenting miniature rainbows. But fountains are wasteful affairs, and most Water Boards frown when requested to tap their water pipes for mere show.

A Puzzled Community.

One summer evening, the people of Waltham, Mass., were startled with the cry that

the Orthodox Church was on fire. The alarm was at once sounded, and a large crowd repaired to the spot, where, apparently, a volume of smoke was seen issuing from the tower of the church, above the bell deck. To all appearances the flames were just ready to burst forth, and the engines were in readiness to throw their streams upon it, when the people were still more astounded by the announcement that the Methodist Church was also on fire, and this too in the tower above the bell deck. Those who were experienced in fire matters were amazed to account for the origin of two fires simultaneously, both in corresponding parts of the church, and the excitement among the people who witnessed the scene was increasing, when they were almost horror-struck to perceive that the Baptist Church was in the same condition, though the smoke appeared to be more dense. All this occurred within a few

seconds, and as it seemed that the flames must first burst from the tower of the Baptist Church, the firemen directed their attention to that edifice, and the ladders had already been placed in position, when, just as the steamer was about to play, the chief engineer concluded that there was no fire on the premises. For three-quarters of an hour after the black volume continued to pour forth, when just before dark it ceased, in about as mysterious a manner as it commenced. This singular phenomena was the absorbing topic of interest throughout the evening, and no one could account for it.

Length, Weight, Measure.

The French standard of length is the metre, which is one ten millionth of the distance from the equator to the pole; it is equal to 39.37079 inches, or very nearly 3,281 English feet. One mile contains 5,280

feet, or 1,760 yards. The acre contains 43,560 square feet. One mile square contains 640 acres. The circumference of a circle is equal to the diameter multiplied by 3.1416. The area of a circle is equal to the square of the diameter multiplied by 0.7854. The United States standard gallon contains 231 cubic inches, the United States standard bushel contains 2,150.42 cubic inches. A cubic foot of water weighs 62.5 lbs.; a foot of hard wood, green, 62 lbs., air-dried, 46 lbs., kiln-dried, 40 lbs.; a foot of soft wood, green, weighs 53 lbs., air-dried, 30 lbs., kiln-dried, 28 lbs. A cubic foot of cast iron weighs 450 lbs.; of wrought iron, 480 lbs.; coke, 50 to 65 lbs.; coal, 75 to 95 lbs.; sandstone, 140 lbs.; granite, 180 lbs.; brick-work, 95 lbs.; gold, 1,040 lbs. No. 1 iron is 5-16 inch thick; No. 3 is 9-32 scant; No. 4 is 1-4 inch; No. 5 is 7-32; and No. 7 is 3-16 inch thick.

The Whirligig Nozzle.

A considerable amount of inventive genius has been directed towards perfecting fire extinguishing apparatus, and adding to department fixtures; the result being quite a number and variety of "patents," some of which are meritorious, while others are merely specimens of embodied nonsense. There are hose-couplings, nozzles, ladder and hose-trucks, fire-escapes, "unburstable" hose, double back-acting ladders, smoke protectors, and various jimcrack devices, which have little or no utility, and they tend not a whit to the proper equipment of firemen. But there is no doubt that some of the novel mechanical contrivances are of utility to fire departments, among which may be the Spherical Water Distributor. It consists of a nozzle closed at the end, with two brass tubes curved like a letter S, open at each

end, hung by the centres at the sides of the nozzle. When the water is let on it is forced through these tubes, and its retro-active pressure drives them around backward, in opposite directions, at a great speed, the water flying to a considerable distance from their outlets. At the same time, beside the revolution on their own centres, they are so arranged as to mutually revolve about the nozzle, thus throwing the water in every possible direction. In case of a fire in a close room, for instance, which could not otherwise be got at, a hole can be cut through the floor above, or the walls, the distributor inserted, and in a moment water is thrown upon every part of the room.

Insurance Brigades.

In nearly all the larger American cities are organizations of men, with appropriate apparatus, whose duty it is to attend fires,

and, so far as possible, protect goods from damage by water, or, in cases of necessity, to remove them from the burning buildings. These organizations are known as Insurance or Protective Brigades, being employed and paid by the local underwriters. The brigades consist of from ten to twenty men, duly officered, the apparatus being fleet horses and light vehicles, with large quantities of canvas and rubber covers, which are impervious to water, together with sponges, mops, brooms, pails and dippers. Whenever an alarm of fire is sounded, away go the members speedily to the designated spot, and if the fire be in an upper story of a building, with a probability of being confined thereto by the firemen, the furniture in the lower stories is immediately placed by the brigade men in the centre of the rooms, and snugly covered with the water-proofs; the goods and stocks are also removed from the shelves

and heaped upon the counters, where they are also carefully covered, with impervious fabric. The manner of placing the covers over the articles to be protected is judicious, sometimes little depressions being improvised in the covering, so as to catch and retain the water which trickles from the rooms above. With dippers the water is removed as fast as it collects, and the flooring is kept comparatively free from water with the brooms and mops, and thus, though thousands of gallons of water may be thrown into the upper rooms, but little of it gets past the intervening brigade men to the rooms below. If "worse comes to worst," and the whole building is likely to submit to the embrace of the ash-maker, then the brigade men hustle out things pretty lively, and convey them to safe quarters. These protective brigades, though independent of the fire companies, work systemat-

ically and harmoniously with them, hundreds of thousands of dollars' worth of valuables being thereby saved, annually, from damage by water or destruction by fire; and though they may be considered expensive adjuncts to fire departments, they are effective, saving to the insurance companies a goodly per cent. of "risks" in "extra salvage." The *spread* indulged in, sometimes, by the brigades is enormous, the goods in the larger warehouses requiring several hundred yards of canvas and covers for their protection.

A Fuss with the Lights.

In putting down the abutments of the bridge across the Mississippi River, at St. Louis, it was found that there was difficulty in extinguishing flame in an atmosphere of such density as exists at a depth of 80 feet, or more, and the burning of oil lamps had to be discarded by the workmen. The cloth-

ing of two of the men having taken fire from contact with some of the hand lamps or candles used in the caisson, it was found exceedingly difficult to extinguish the flames. One of the men was severely burned, although his garments were almost entirely woollen. It was deemed unsafe to risk the danger of having the clothing of the men saturated with oil from the accidental breaking of a lamp, which might, by the same casualty, ignite their garments and thus endanger their lives. The flame of a candle would immediately return to the wick after being blown out with the breath. At the depth of 108 1-2 feet below the surface of the river was blown out the flame of one candle thirteen consecutive times in the course of half a minute, and each time, excepting the last, it returned to its wick. Almost as long as a small portion of the wick remained incandescent, the flame would

return, and when the glowing particle of two separate candles failed to possess sufficient heat to restore the flame to either, it would reappear at once by placing the luminous portions of the two wicks in contact.

The Chemical Engine.

In another part of this volume reference is made to machines charged with carbonic acid gas for extinguishing fires. Those little squizzlers should not, however, be confounded with the large self-acting chemical engines which have been introduced into many American cities.

The large carbonic power-engine costs about $2,000, is simple in its construction, safe, and always ready for instant use. It is substantially made, with two polished copper tanks, or "generators," which are tested to 350 lbs. hydrostatic pressure to the square inch, and is furnished with a

double acting force-pump. The engine forces a stream through any length of hose, at any height, that is just as powerful as though thrown through a single length from the ground. This is a feature that no water engine possesses. The most powerful steamer throws a comparatively feeble stream when the hose is led to the top of a lofty building. This is owing partly to the friction in the hose, the weight of water, and most of all to the fact that all the propelling force is behind the water at the steamer. With the chemical engine any pressure can be obtained, and the propelling force goes out with the stream, thus giving nearly the same pressure at the nozzle as at the engine. The pressure is kept up in the tanks or generators by means of the chemicals employed, and can be regulated by merely turniug a valve.

The claims for superiority of the engine

are that it dispenses with complex machinery, experienced engineers, reservoirs, and steam. Carbonic acid gas is both the working and extinguishing agent: no steam to be raised, no fire to be kindled, no hose to be laid, and no large company to be mustered. The chemicals are kept in place, and the gas generated the instant wanted. Mere water inadequately applied feeds the fire, but carbonic acid gas never. Bulk for bulk, it is thirty times as effective as water, the seventy gallons of the two small cylinders being equal to twenty-one hundred gallons of water. Besides, it uses the only agent that will extinguish burning tar, oil, and other combustible fluids and vapors. One cylinder can be re-charged while the other is working, thus keeping up a continuous stream. Five or six men can draw it and manage it. Its small dimensions require but a small area either for work or storage.

One hundred feet or more of its light pliant hose can be carried on a man's arm up any number of stairs inside a building, or, if fire forbids, up a ladder outside. It smothers, but does not deluge; the modicum of water used to give momentum to the gas is soon evaporated by the heat, doing little or no damage to what is below. It costs only about half as much as a first-class hand engine, and about one-fourth as much as a steam engine with their necessary appendages, and the chemicals for each charge cost less than two dollars.

In reports of fires, it is often found that the water used to extinguish them has occasioned more damage to stock than the flames. And it is also a notable fact that fires frequently reappear after steamers have been playing for hours upon the debris, owing to ignition caused by sparks falling upon the charred and splintered wood-work.

Now, by the employment of carbonic acid gas these evils are overcome. In the first place it is the gas that extinguishes the fire, by absorbing the oxygen upon which it feeds, the water being used simply as a means of conveyance, thus preventing the useless dissemination of the gas before it reaches the flames. The flames once deprived of oxygen, become extinct.

The philosophy of the operation consists in the fact that carbonic acid gas is heavier than the atmosphere. Fire is combustion by means of oxygen, and cannot burn a second without it. The contents of the extinguisher — a solution in water of a gas much denser than air — shuts off the supply of oxygen, and smothers the fire. Fire goes out instantly in an atmosphere containing about ten per cent. of carbonic acid gas.

Bird's Discovery, and his Little Squirt.

In Eastern Massachusetts there resides a gentleman named Bird, who thinks he has a special mission to perform in the world of lesser conflagrations. Having made the remarkable discovery that a small fire does not require a large quantity of water to quench it, he is sanguine in the opinion that small force-pumps are handy and useful things to have around, wherever miniature conflagrations are liable to occur. So wonderful seems the discovery to him, and so strong is his faith in the little pumps, that he has written more than a score of communications for the newspapers in blowing his horn; and he has, of course, obtained the endorsement of his friends for his pet notion, and recommendations for his *petit* machines. And, while nobody doubts the efficacy of his plan for putting out sparks, yet there are

some people who can but smile at the gentleman's enthusiasm in behalf of his hobby.

The idea of having fires extinguished before they get under much headway, however, is a good one, and Mr. Bird may be worthy of immortality for his brilliant conception, while his little squirts may deserve to go to posterity along the coming ages as very valuable extinguishers. Why did he not, while he was about it, evolve from his brain the greater fact that it would be better still not to have fires break out at all, and thus do away with the necessity for any fire apparatus?

But the truth is, the fires which trouble people in this world are those which get well a-going, not those little "catches" which may be pinched out. The mass of people do not, nor will they have little force-pump on the brain. Petty fires and pocket extinguishers

can never attract more than local attention; though it were well that Mr. Bird, and men of his stamp, should receive a due mead of praise for good intentions.

"*Lighten-up on the Hose.*"

A very important adjunct to fire apparatus is proper suction and leading hose for the conveyance of water from reservoirs, hydrants, and engines. Until within a few years, leather was the material exclusively used in the manufacture of leading hose, the best quality of the article being required to produce hose to withstand the pressure of high heads of water and the impulsive spurts of the fire-engines. The new leather hose from the best makers serves well, but it needs care in keeping it oiled, and being properly dried after every use. After long use, or improper care, leather loses its tenacity of fibre, and a great deal of delay and

loss at fires occur by reason of the untimely bursting of rotten leather hose. The standard adopted by the officials of the best fire departments, is pure oak-tanned Baltimore or Philadelphia leather, warranted such, and known as "overweight," the average weight of which is not less than twenty-two pounds to the side, none being used for "standard" which weighs less than twenty pounds to the side. The seam is double riveted, with twenty-two copper rivets, of No. 8 wire, to the running foot, the splices being made with thirteen rivets of size No. 7 wire. The hose, when finished with loops and rings, weighs sixty-four pounds each fifty feet, exclusive of the couplings, and is guaranteed to stand a pressure of not less than two hundred pounds to the square inch. It is thus apparent that from the ox-gut hose of the Ancients to the ox-hide hose of the Moderns there was a pretty long step of

improvement, and the water may now be let on in earnest.

There are also several other kinds of hose, covered by one or more "patents," which are manufactured of linen, cotton, hemp and rubber, separately or in combination. Some of these hose are of great strength and durability, one or two kinds being even superior, in some respects, to the leathern article; and it is not improbable that the latter will be generally superseded when more improvements shall have been made in the textile and resinous materials with which the "patents" are composed.

The following are the "specifications and claims" for the latest invention in the hose line: it is constructed of two distinct hose, one within the other, the inside one being lined with rubber, and sufficiently strong to stand the pressure of steam fire-engines. The outer one, or jacket, is for the purpose

of protecting the hose from damage or street wear, at the same time doubling its strength. Its weight is forty-six pounds to each fifty feet, including couplings. It can be repaired without the introduction of metallic sleeves, and in a manner like the original fabric, and of equal strength. It is durable, for the reason that a layer of pure gum, unvulcanized, is interposed between the hose and the vulcanized lining, while in rubber hose the presence of acid in the sulphur used for vulcanizing being a gradual, sure, and steady cause of decay to the cotton duck of which the rubber hose is composed; so that the only condition to secure durability to the hose is to hang it up in a dry place, either by its whole length or by the middle, allowing the couplings to hang down, or by any mode of laying it out in single thickness. Few persons, when considering the merits of a cotton hose coated with rubber on one

side only, realize the fact that rubber hose is made of cotton duck, coated on both sides with a composition partially of rubber, cut into strips for the purpose of winding it spirally into a tube, and submitted to a heat of nearly 300 degrees to vulcanize it. Another point is the patent coupling, holding the hose in such a manner that it is impossible for water to reach the outer fabric from its inside. Still another, is the rubber ring in the end of the coupling, forming a cushion between the hose and the coupling, to prevent wear or breaking of the hose at that point. In applying the coupling, the hose is placed inside the tail of the coupling, and the clear diameter is two and one-half inches, while with other couplings the hose is placed outside of the tail-piece ; and in order to have the hose go over a tail-piece which has a two and one-half inch hole in it, the hose requires to be made larger. Therefore, to

avoid doing so the coupling is reduced, and nearly all couplings measure but two and three-eighth inch openings.

Substitutes for Water.

From the earliest ages water has been considered as the great means provided by nature to act as the antagonist to fire. Throwing water from buckets and other vessels on burning buildings, to extinguish the fire, is ancient; but modern improvements in the method of applying, and thereby rendering it more efficient, are numerous. Attempts have been made at various times to increase the efficiency of water when used in extinguishing fire, by mixing or dissolving some chemical substances with it; but however well such a proceeding may have turned out when tried on a small scale as an experiment, say, for example, in the laboratory of a chemist, a few moments'

reflection shows that it would be both costly and inadmissible in practice. The employment of material which would render whatever it was applied to incombustible, also dates from a remote period. Archelaus, a general of Mithridates, during one of the wars with the Romans, caused the wooden towers used in the battle to be washed over with a solution of alum, by which means all the attempts of his opponents to set the wood on fire were rendered abortive. The idea of extinguishing fires "chemically," seems to have gained strength of late years; for, from time to time, accounts are found of some contrivance for using "ammonia," "carbonic acid gas," etc., or else patents obtained for its application, or that of some peculiar combination of "chemicals." There can be no doubt that in theory the extinguishing of fire by some such arrangement or mode of treatment is practicable; and

that pretty little experiments in the laboratory of the chemist give satisfactory results and proofs of all that can be advanced in its favor; but practice at a real fire, that stern "*experimentum crucis*," which overthrows so many pretty theories, soon dissipates the fond idea of those who have devoted their time and money introducing it, and gives still stronger proof of the inapplicability of such plans to the present circumstances of fires, buildings, etc., as could not fail to be seen by them had they attended a thorough fire, and paid attention to all the circumstances connected therewith.

Firemen's Charitable Associations.

These institutions are formed, and sometimes incorporated by State authority, in many of the fire departments throughout the United States, for the purpose of affording relief to such of their members as may receive

injury while performing their duties as firemen. Any member of a department having such an association, who enrolls his name in the list of the association and pays a nominal specified fee, receives assistance during the year his certificate is dated; his physician, medicine, and other necessary bills are paid, and a sum is allowed him for lost time during inability or sickness, not exceeding a specified amount, which is usually liberal. This assistance is continued during the whole time of such inability or sickness. Many of the associations receive generous donations from the public, and in some instances the amount of funds on hand for benevolent purposes is quite large. No feature of a fire department is more worthy of commendation than a properly conducted and a well endowed charitable association. After the great fire in Boston, 1872, more than $50,000 is said to have been disbursed by the association to

injured firemen, and to the families of such as had been killed.

"*Burned at Sea!*"

Many vessels are destroyed by fire, and the history of the American naval and mercantile marine is full of those sad occurrences. Ships, propelled by sails and steam, leave ports every month which never make other harbors, because of getting burned on the lakes, rivers and oceans which they attempt to pass. The full horror of such catastrophes can never be realized except by those who have experienced the awful perils; and the bare contemplation of such scenes were enough to produce dismay to the bravest hearts. "The ship is on fire!" Did anything more terrible ever fall upon mortal ear? Truly the dangers of the deep are many, the worst being that of fire.

With all the safeguards and appliances for

extinguishing fires on shipboard, the report often comes, "Burned at sea!" Can it be possible that human ingenuity for devising means of safety to ships from fire has reached its limit? If not, the number of such disasters should diminish. With plenty of water always at hand, and the much-vaunted carbonic gas, it would seem that they might and should be made available to the suppression of the fires arising from spontaneous combustion or other causes.

Attempts to convey soft coal from England to San Francisco have resulted in the destruction of the carrying vessels and cargoes, by reason of evolved gas taking fire. The application of a little *science* to such coal would "fix" its gas, and make it less hazardous to transport. Who will discover and present the proper precautions to insure safety against fires at sea?

Instruction and Drill.

One of the features of the Metropolitan fire departments consists of classes for the instruction of the officers in their various duties. The first-class is composed of the engineers and officers; the second-class is composed of company commanders; the third-class is composed of officers not commanding companies; and the several classes meet weekly for instruction and drill. In most cases the meetings are steadily and profitably maintained. The forms of instruction embrace a regular course of mechanics, hydraulics, the construction of steam fire-engines and fire apparatus, the management of fires, and collateral subjects bearing upon the duties of the officers, and great improvement is obtained in the practical working of the force.

Length of years of fire service, coupled

with a certain amount of personal geniality or shrewdness, has generally been considered an all-sufficient title for command in many fire departments, and, given these, a man's other qualifications or attainments have not been deemed a matter of importance; so that if a man had experience in *using* fire apparatus, it has been considered unnecessary for him to understand the construction of it, or to know familiarly and well the laws which govern the machinery, as well as the element which it employs against that other "element" which it is constructed to subvert. Such schools of instruction should be regarded as essential; and if firemen would elevate their organization to the dignity which some are disposed to claim for it, they ought not neglect a matter so obviously to their advantage, and to the advantage of the property they guard. No claim for toleration on the score of experience alone should stand for a

moment in the light of this age of intelligent investigation; experience is valuable, but education is as valuable.

The Burning of Moscow.

Sir Archibald Allison, in his history of the burning of Moscow, indulges in some pretty fine descriptive writing. From his account, it appears that it was chiefly during the dark nights of the 18th and 19th of September, 1812, that the conflagration attained its greatest violence. At that time the whole city was wrapped in flames, and volumes of fire of various colors ascended to the heavens in many places, diffusing a prodigious light on all sides, and attended by an intolerable heat. These balloons of flame were accompanied in their ascent by a frightful hissing noise and loud explosions, the effect of the vast stores of oil, rosin, tar, spirits, and other combustible materials with which the

shops were filled. Large pieces of painted canvas, unrolled from the outside of the buildings by the violence of the heat, floated on fire in the atmosphere, and sent down on all sides a flaming shower, which spread the conflagration in quarters even the most removed from where it originated. The wind, naturally high, was raised by the sudden rarefaction of the air produced by the heat, to a perfect hurricane. The howling of the tempest drowned even the roar of the conflagration; the whole heavens were filled with the whirl of the volumes of smoke and flame which rose on all sides, and made midnight as bright as day; while even the bravest hearts, subdued by the sublimity of the scene, and the feeling of human impotence in the midst of such elemental strife, sank and trembled in silence. The flames, fanned by the tempestuous gale, advanced with frightful rapidity, devouring alike in their

course the palaces of the great, the temples of religion, and the cottages of the poor. For thirty-six hours the conflagration continued at its height, and during that time above nine-tenths of the city was destroyed. The remainder, abandoned to pillage and deserted by its inhabitants, offered no resources to the invading army. Moscow was conquered; but the victors had gained only a heap of ruins. It is estimated that 38,800 houses were consumed, and the total value of property destroyed amounted to $150,000,000.

After a Great Fire.

"Life has gone out as well as property. Men have been crushed by falling walls while trying to save property; firemen have been overtaken by the flames while doing their duty. Men will be missing, and friends will speak of them as having been swallowed up in the great fire. New entries will be made

in the journals of business men, in the community and in the family; they will date back to the great fire. It will be a turning-point in men's lives; a starting-point. To a great many it will be a start from the bottom of the ladder. They must go over again all the hard struggles, fight the great battles, meet and conquer difficulties. They were going to take things easy the remainder of life. Gray hairs have come in fighting the battles of the past. The brain tires, the limbs grow weary, the hands hang down as they did not in former years. It is hard to think of it. There is a choking in the throat. And if now and then a tear starts unbidden to the eye, who will not respect it? There is manliness in tears. The man is to be pitied who cannot weep at his own or at others' misfortunes. But the men who reared those structures now consumed are not of those who wring their hands and

make loud lamentations over disaster. How calmly they gaze upon the ruin! With what clearness they look at the future! How prompt to plan, how quick to execute! While the spot is still an abyss of flame and smoke they are contracting for new edifices that shall be more substantial, more palatial than those that have crumbled to dust and ashes. But sweeter and more fragrant is the flower, that, while the flames are raging, unfolds its blossom in city and town and hamlet,— loveliest flower of the celestial graces,—Charity. The world presses its benefactions upon us. The telegraph makes us neighbors. Christianity has made us brothers. The whole human race is our kin; and while the fire burns, this one call comes to us from the prairies, from beyond the Sierra Nevadas, and from across the Atlantic, 'What can we do for you?' It is the anthem following the hymn sung by the angels

of Bethlehem, 'Good-will to men,' and it is the best part of the story of a Great Fire."

And there shall be no more Fires.

Did you ever, reader, contemplate upon the probability that the time may come, and that, too, in the no very remote future, when there will be no need for fire-extinguishing apparatus, nor for firemen? That such may be the case is not improbable, for there will be no conflagrations when fire-proof construction becomes universal; and such construction will be universal whenever there is no combustible material with which to build.

That the era of wood is fast passing away, must be apparent to all thoughtful observers, and at the present rate of destruction of the world's forests, there must soon be a dearth of timber. Whole provinces on the Eastern continent have been denuded of their timber-trees during the last fifty years, while on

this continent the trees which have imbibed the sunshine and battled the storms of centuries are disappearing at a rate very largely in excess of the natural growths. The timber and lumber forests of Maine, Michigan, Oregon, and Canada are falling before the assaults of the woodmen with their axes, at a ratio to growth greater than geometrical progression; the yearly "cut" being more than bounteous Nature furnishes during a decade.

It can, therefore, be but a matter of limited time when the loggers' occupation will be gone, and when ships, habitations, and marts of trade will have to be constructed of material unburnable, for there will be none other. Then the last fire department may disband without detriment to the community, and somebody may issue another edition of this book announcing the fact in a postscript, closing with the word — "FINIS!"

The Fireman.

"OFT, when our populace is sleeping,
(Save those who nightly watch our keeping,)
When silence broods o'er hill and dale,
And shadows cross the moonbeams pale,
A cry is heard amid the gloom —
The warning of impending doom —
Fire ! Fire ! Fire !

"The fireman, from his slumbers waking,
At once his quiet home forsaking,
Regardless of both health and life,
Rushes to the deadly strife.
While still the cry of wild despair
Is wafted on the midnight air,
Fire ! Fire ! Fire !

"Though winds and tempests howl around him,
Yet these combined do not confound him ;
He strives his courage to maintain,
Spite of the stormy hurricane,
As higher, and still higher, rise
The flames enraged, to meet the skies —
Fire ! Fire ! Fire !

"Fearless, he leaps into the danger,
Saves the goods of friend or stranger —
Saves, perchance, some precious life
Of father, husband, child, or wife.
(Such deeds the fireman oft hath done,
And thus immortal honors won,)
Nor tires he till the joyful shout :
All out ! All out ! "

Burning of the Tenement Building.

"ONE, Two, Three, Four!
The fire alarm comes loudly tolling,
Over the roofs of the city rolling,
And dying away on the island shore.

"One, two, three, four!
Engines over the pavements leaping,
While lusty tides of the firemen sweeping
Down through the channelled avenues pour.

"One, two, three, four!
The panting foreman's trumpet bellows,
'Pull her along and jump her, fellows!
All your muscle, and something more!'

"One, two, three, four!
The shrieking crowds of the boys that follow,
The cries of the firemen hoarse and hollow,
Startle the night with a fitful roar.

"One, two, three, four!
The red shirts down to their labor settle;
Every fellow is full of mettle,
Muscle, and courage, and something more.

"One, two, three, four!
The owner hears the fire-bell toll;
It is his district — but, bless your soul!
All is insured, and fires are a bore!

"The tenement buildings are red and flaring,
The narrow street with the crowd is choking,
The opposite houses are hot and smoking,
The windows like bloodshot eyes are glaring.

" Golden jets, like fiery fountains,
Over the tall roofs leap and spatter ;
Till, struck by the wind, they break and scatter,
While ever the smoke piles up like mountains.

" Fire, fire, fire, fire !
Hark to the roar of its hollow laughter,
As it swirls all over each rotten rafter,
Drunk with the heat of its own desire !

" See how the jets from the hose-pipes battle
All in vain with the floods so furious ;
Hark to those sounds so hollow and curious,
Like mournful lowing of distant cattle !

" See how the blinded firemen clamber,
Step by step, up the smoking ladder ;
And how the fire grows madder, madder,
As it thrusts them off from that stifling chamber !

" See how the crowds that are watching shiver,
As they see in the midst of that tide abhorrent
A black shape flash through the golden torrent,
Like one that drowns in a fiery river !

" See that woman at the window flicker,
Holding a child in her hands and shrieking.
Ah ! she's gone, even while we're speaking,
And every heart in the crowd grows sicker.

" List to that sound that so hollowly rumbles !
The firemen pause, for they know what's brewing,
Then down with a roar, in a crimson ruin,
The tenement building tumbles."

SPARKS.

"From dome to dome the flames infuriate climb,
Sweep the long street, invest the tower sublime,
Gild the tall vanes amid th' astonished night,
And reddening heavens return the sanguine light;
While with vast strides and bristling hair aloof,
Pale Danger glides along the falling roof,
And Giant Terror, howling in amaze,
Moves his dark limbs across the lurid blaze."

** On the occasion of the burning of a Methodist book-store, in New York, among the burning fragments of books and printed sheets whirled aloft upon the wings of the flames, and borne onward upon those of the wind, was a page of the Bible containing the 64th chapter of Isaiah. It was picked up about twelve miles distant, on Long Island, and before the catastrophe was known there. Every word of the page was so marred as to be illegible, save the eleventh verse, which reads — "Our holy and beautiful house,

where our fathers praised Thee, is burned up with fire; and all our pleasant things are laid waste!"

** It has been demonstrated that after water has reached a temperature of 212 degrees Fahrenheit, or commenced to boil, five and a half times as much heat is necessary to convert it into steam as was necessary to raise it from the freezing to the boiling-point. This is usually expressed by saying that 990 heat-units are necessary to convert 1 lb. of boiling water into steam.

** In proportion to the population, it is stated that of the large cities in the United States, the Boston, Mass., Fire Department is the most expensive, while the Fire Department of Baltimore, Md., is the least expensive.

** "The story of the Great (Boston) Fire," as told by "Carlton," and illustrated by Bil-

lings, made a book of thirty-two pages, which sold for 75 cents.

** Calling fire an "element" is a common and convenient mode of expression; but fire is not an element at all, being only a result of combustion, — a uniting of oxygen and carbon.

** The Emperor Trajan, writing to Pliny, who was Governor of Bithynia, and who had asked instructions from headquarters in regard to raising a company of professional firemen, said that they were not the most peaceable citizens possible, and that "they would not fail to form themselves into factious assemblies."

** The latest effort to make wood incombustible subjects it to a "pickling" process in a solution of tungstate of soda and water, of the specific gravity of 1.2, the tungstate being made by the addition of tungstate of lime to hydrochloric acid and salt. It is

claimed that the pickle renders soft woods hard and unburnable.

** Of all the diabolical individuals, next to deliberate and cold-blooded murderers, "fire bugs" are the most dangerous to a community. Why such beings should exist is one of the mysteries which God has not seen fit to explain; but it is the duty of society to protect itself, and no better way is apparent than to shoot the incendiary at sight, or to hang him forthwith. It is often difficult to catch the "bug," but when smoked out a finality in behalf of safety should ensue.

** A poet has sung of woman as one who "scatters roses of bliss on man's thorn-covered ways." It would conduce to the public safety if she would oftener spank and "scatter" the small boys who play with friction-matches.

** There is a popular notion that sunlight has a tendency to put out fire; but

experiments prove that light does not at all effect the process of combustion.

** While the firemen of Baltimore, Md., at a fire in 1868, were digging victims out of the ruins of a building, James W. Sommers, a comrade, said: "I can hold out a little longer; take care of some one who is suffering more." He died a martyr to his own heroism.

** The chief of the Charleston, S.C., Fire Department states that on the 11th and 12th of December, 1861, about twelve hundred houses were destroyed by fire in that city.

** Some time during the sixteenth century, Michael Angelo translated into the Tuscan tongue an old Latin work on metal mining, and in this described a method of disintegrating or breaking rocks by fire. A furnace, mounted on wheels, is closed all around except at the back, where the flame has an outlet through which to play upon the rock

to be excavated. At the front is a blower suitably connected with the furnace, and serving the double purpose of providing air to maintain combustion, and of directing the flame through the opening against the rock. The machine being run into position, the rock, to a considerable depth, is heated to a high temperature, whereupon the apparatus is drawn back and a pump jets cold water against the surface. This causes the stone to fracture and split.

** Much leather hose is prematurely injured by being treated with *slushes*, under the name of "leather preservatives." Vegetable and fish oils should never be used, but beef tallow, mixed with neat's-foot oil, applied warm, before the hose is quite dry, serves to a good purpose. Whatever is cheaper is less effective as a preservative.

** The total length of water-pipes, January, 1875, in New York, was 400 miles;

Chicago, 350; Brooklyn, 300; Boston, 350; Baltimore, 210; Detroit, 170; St. Louis, 150; Montreal, 110; Louisville, 75; Cleveland, 70; Jersey City, 60; Milwaukee, 40.

** The New York Fire Department is composed of ten battalions, with forty-two steam-engine companies, and a total of 738 men. There is connected with it an organization of Sappers and Miners, whose duty it is, in cases of necessity, to blow up buildings and topple over walls with an explosive known as *dymnamite*. [A boy who got blowed over by the stuff, called it "dam-it."]

** Anybody who has not heard wonderful stories about firemen's dogs has not been through smoke, nor visited an engine-house. Some of the "dog yarns" are spun from facts, while others are twisted from bow-wows of doubtful authenticity.

** Firemen should respect themselves if they would have the respect of other people.

A man may be a man, if inclination or duty persuade him to fight fire; but to fight the "tiger" of evil by embracing it, a man is no man at all.

** Mr. Fred. J. Miller, of New York, advertises that he is prepared to fill orders for firemen's supplies, from a badge to a steamer. His business circulars are illustrated, and abound with matter interesting to firemen. He is an enterprising and "square man."

** Death and fire have all seasons, and it were well were all people always ready for either or both. Reader, is your "escape" at hand and in order, and are you "insured in safe offices"?

** Among the unsolved problems are how best to suppress prairie and forest fires, burning cargoes of cotton, oils and chemicals. Some enthusiastic fire commissioners invoked "science" on the subject, but the sums don't solve.

** The "Automatic System" of fire alarm, which is in operation in many of the smaller cities, answers well the purposes desired, and, though loaded with "patents," is less expensive than the "Central System." By the "automatic" plan an alarm at the box sounds directly on the gongs and bells, without the aid of a grand head-centre operator.

** Underwriter Hope calls coal oil, of a standard below 150 degrees, "hell fluid"! He hopes all such oil may be tempered to a degree of safety; to which the response should be, — "So hope we all."

** The Chief of the Pittsburg, Pa., Fire Department has an avoirdupoise of 288, while the Chief of the Fall River, Mass., Department tallies less than half of that force of numericals. Both are mighty men at fires.

** The velocity of streams of water, flowing from higher to lower levels, is invariably

and directly proportionate to their depth, diminishing and increasing therewith; the greatest velocity is at the surface, the least at the bottom, and the mean velocity at half the depth; the increase of velocity as the surface is approached is in the simple ratio of the distance from the bottom; the volume of the flow may be found by multiplying the breadth by the average depth, and the resulting product by the mean velocity. It has been demonstrated that the centres of streams of water projected through fire-hose and nozzles move faster than the other portions of the water.

** A flouring-mill at Milwaukee was burned a few years since from a candle held near a bran or feed-spout reaching from the upper to a lower floor, and similar catastrophes have occurred at other places, the flames in every instance breaking out suddenly from contact of fire with the dust or

powder floating in the mill or passing through the spouts. All lights used in such mills should be covered with wire gauze.

** Metropolitan Fire Departments involve the application of a "code" as follows: All candidates are strictly examined; no boys, old men or unsound men are accepted; the sick and wounded are properly cared for; unfit and incompetent officers and men are eliminated from the force; officers are only commissioned and promoted upon a fair and thorough examination; and no man is accepted or excluded by reason of his birth, position, politics, nationality or religion.

** The Nashville, Tenn., fire alarm telegraph is considered an improvement on the common automatic system; by it only the alarm from one box will be sounded, although there may be others turned on from different boxes. The first box turned on invariably has the right of way, and cannot be interfered with.

** On the morning of September 19th, 1874, a large cotton factory, known as Granite Mill, at Fall River, Mass., took fire and was destroyed, involving a large loss of life. Why may not each window in the higher stories of such buildings be provided with a flexible wire cable ladder, with one end permanently fastened to the window-sill and the ladder coiled till wanted to be let down in case of fire? It would seem that if ladders for such purposes were made nearly as wide as the windows, and of sufficient length to reach to the ground at an angle of, say, forty-five degrees, the lower ends might be secured with spikes by the firemen or spectators, thus affording easy and safe "escapes" to timid or frightened women.

** The most forcible and fiery contribution, probably, ever made to "resolution" literature was on the occasion of the disbanding of the Boston Fire Department in 1837.

Every company "went out" of service hurling indignation at the city officials, in the form of "cards" expressive of "our sentiments," and each series of "resolves" were prefaced by little texts of sarcastic bitterness.

** At a parade of the Fire Department in West Troy, N. Y., one of the hose carriages, a "veteran," was placarded: "Old age demands rest." "Long and active service is worthy of recognition." "Thirty years' active service." "I ain't so young as I used to be." "Built in New York, 1844; run in Philadelphia ten years, Poughkeepsie eight years, Lansingburgh four years, Cohoes eight years." "I cannot last forever."

** The number of regularly organized Fire Departments in the United States is said to be thirteen hundred.

** Many companies operating hand engines have mottoes which are attached to the

machines, and form rallying cries, such as — "We Will Endeavor;" "We'll Be There;" "Always Ready;" "Faithful and Fearless;" "We Serve;" "Where Duty Calls, There You'll Find Us;" "We Are at The Front;" "Before we Limber Up, pass the Words 'All Out.'"

** *Fireman.* — "I say, Citizen, did you go to the fire last night?" *Citizen.* — "No, I do not run with the machine, and so I never turn out when there are fire alarms, unless my bed-room walls are hot." *Fireman.* — "Sensible. I wish there were more like you; for the fact is, great crowds of spectators at fires are great nuisances."

** Men of science have demonstrated that the heat which is thrown out from each square yard of the sun's surface is as great as that which would be produced by burning six tons of coal on it each hour. Will the sun forever supply light, heat, and chemical

force? The aforesaid "men of science" affirm that it will not; but that it will, in due time, "weld with all its surrounding planets, and roll, a cold black ball, through infinite space."

** Fire seems to have got the best of the moon, and gone out. Astronomers, with their telescopes and spectroscopes, have discovered that there is no atmosphere or water there, and extinct volcanoes everywhere abound on the surface and deep into the bowels of "Pale Luna"; appearances indicate that there must once have been hot times thereabouts.

** About thirty-five years ago a mob burned a convent in Somerville, Mass., and the scenes then and there enacted were a disgrace to New England notions of fair play. Some of the firemen made worse than fools of themselves on the occasion, by sympathizing with the rampant mob spirit.

One fellow stood upon his engine and attempted to auction off some articles taken from the burning building. The despotism of a mob, be it of border ruffians or firemen, is unreasonable and cruel. They who would commit unlawful violence should bear in mind the fact that though the mills of the gods seem to grind slowly, they do, nevertheless, grind surely toward exact justice.

** The monkey tribe have not the instinct or reason to extinguish fire; but in case of fire breaking out in their haunts, they invariably "scoot." Now the question arises, if Darwinism be true, how did the primitive man get his notion to do a little water-throwing when his cabin got ablaze? He certainly did not *inherit* the propensity from his grandfather Ape.

** Mr. Carpenter sharpens tools on an oil-stone, and in doing so spills oil upon the saw-dust which is laying around loose. This saw-dust sifts through between the crevices

of the first flooring, after which a second and tight floor is laid, leaving the oiled sawdust to slumber. After a while, however, it may be months, the oiled dust oxydizes, combustion ensues, and "a most mysterious conflagration" is reported.

** It is interesting to observe how adroitly an ambitious fireman will get into his boots, breeches and coat, while on the run for his engine-house, in order to be the first man there. The performance looks a little ridiculous, but the sensation is delightful to the performer, if he but wins the trumpet or the neap.

** Parties desiring more special information relative to the subject-matter of this volume, may communicate with the publisher, who has complete lists of all the manufacturers of fire extinguishing apparatus, and the dealers in Firemen's Supplies.

** HERE ENDS PATCHWORK, WITH ITS WEFT AND WOOF OF FIRE.